SOIL SURVEY OF WALWORTH COUNTY, WISCONSIN.

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DESCRIPTION OF THE AREA.

Walworth County is situated in the southeastern part of Wisconsin. Its southern border is the Illinois-Wisconsin State line, and its eastern border is about 24 miles from Lake Michigan. Elkhorn, the county seat, is 71 miles from Madison and 56 miles from Milwaukee.

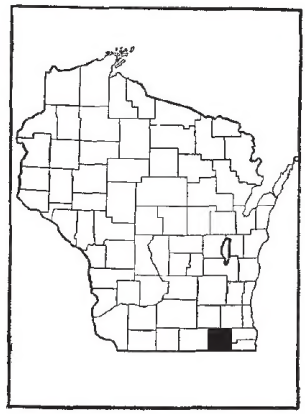

FIG. 41.—Sketch map showing location of the Walworth County area, Wisconsin.

The county has the form of a square, measuring 24 miles on each side. It comprises a total land area of 560 square miles, or 358,400 acres. The area of the lakes within the county amounts to approximately 14 square miles.

The most important physiographic feature of the county is the series of moraines which mark the different stages of the glacial ice as it advanced and retreated over this region. This county was traversed by the Delavan lobe of the Lake Michigan glacier and by the Green Bay glacier. Where these two great ice sheets came together there was formed what is known as the Kettle moraine. This begins near the village of Richmond in the western part of the county and extends in a northeasterly direction, terminating in Kewaunee County. This Kettle range, which received its name from the numerous holes and pits resembling large kettles, is evidently a gigantic moraine and forms the main topographic feature of eastern Wisconsin. It ranges in width from 1¼ to 3 miles and is extremely rough and broken throughout its extent. Southeast of Whitewater it rises about 200 feet above the surrounding country and is the most conspicuous feature of the landscape.

The Darien moraine, extending southeast from Richmond, is the terminal moraine of the Lake Michigan glacier. From 3 to 5 miles back from this is the recessional moraine known as the Elkhorn moraine. Extending west from Richmond is the terminal moraine of the Green Bay glacier known as the Johnstown moraine. From 3 to 5 miles north of this range of hills is the Milton moraine. All of these merge into the Kettle moraine.

The Darien moraine is the most important in Walworth County. It has a width of from 1½ to 3 miles and varies considerably in degree of relief. Between Richmond and a point opposite the head of Del-

avan Lake the relief is only 20 to 40 feet, near the village of Walworth it reaches 100 feet, and south of Lake Geneva the long slope rises from 100 to 150 feet above the low land to the south.

The greatest relief is found in the slopes of Lake Geneva basin. In the western part, between Cook's Camp and Camp Collin, the lake reaches its greatest depth, which is 142 feet. The bottom of the lake is 719 feet above sea level, and the crest of the moraine, 1½ miles southeast, is more than 400 feet higher, or about 258 feet above the level of the lake.

Northeast from Lake Geneva the topography is very irregular. The morainic belt is interrupted by depressions with abrupt surrounding slopes. In places there is a strongly marked knob-and-kettle topography. Abrupt knolls and ridges of gravel alternate closely with deep round pits and narrow winding depressions, and 30° slopes and 40 to 100 foot reliefs are not uncommon.

Outside of these morainic regions the ground moraine has a topography ranging from level to gently undulating. In the region of old glacial drift in Sharon Town the surface consists of long, gentle slopes, and the outwash plains to the north and east are level.

Along the streams there are narrow belts of bottom land subject to overflow, and also numerous marshes. These are most abundant in the southeastern quarter of the county and in the northern part.

The general elevation of the county ranges from about 822 to 1,004 feet above sea level. The following elevations have been indicated along the railroads: Elkhorn, 996 feet; Darien, 943 feet; Delavan, 938 feet; Lake Geneva, 892 feet; Walworth, 1,004 feet; Genoa Junction, 845 feet; Whitewater, 822 feet; and Troy Center, 891 feet. One of the highest points in the county, 1,119 feet above sea level, is south of Lake Geneva.

Walworth County lies on a drainage divide, and there are no large streams crossing the county. The drainage of the western part is carried chiefly by Turtle Creek, one branch of which has its chief source in the marshes in Richmond and Sugar Creek Towns. Another branch forms the outlet of Delavan Lake. Turtle Creek flows into Rock River at Beloit (Rock County) and then into the Mississippi after traversing Illinois. In the eastern part of the county White River forms the outlet of Lake Geneva and Lake Como. This stream empties into Fox River at Burlington. Most of the land in the northeastern part of the county is drained by Sugar Creek and Honey Creek, which also empty into Fox River. Branches of these various streams form drainage outlets for practically all parts of the county. From a geological standpoint the country is practically new, and the streams have not formed deep channels, but are still cutting their beds. Most of the streams have fairly good fall, and in a few places water power has been developed, but at present is not used extensively in any part of the county.

The first settlement in Walworth County was made in 1836 in section 25, Spring Prairie Town. The first claim was taken up at Lake Geneva in 1835. The county was formed by a territorial act of Wisconsin in 1838 and began to function as an independent government in 1839. The early settlers were of Anglo-Saxon descent and came chiefly from New York, Pennsylvania, Illinois, Indiana, and Ohio. All parts of the county are now thickly settled and highly developed. The population of the county in 1910 was 29,624, and in 1920 it was

29,327. Elkhorn, the county seat, had a population of 1,991 in 1920; Lake Geneva, 2,632; Delavan, 3,016; Whitewater, 3,215. Other towns of less importance are Sharon, Darien, Walworth, Genoa Junction, Springfield, Lyons, Troy, and East Troy. All of these towns are surrounded by good agricultural country and are distributing points for farm machinery and shipping points for farm produce.

The first railroad was built through Walworth County in 1851. This was a part of the line now known as the Chicago, Milwaukee & St. Paul, and was completed from Milwaukee to Prairie du Chien in 1856. The line which is now the Chicago & North Western, connecting Racine and Beloit, was completed in the county in 1856.

Walworth County is well supplied with transportation facilities. The Racine & Southwestern division of the Chicago, Milwaukee & St. Paul Railway crosses the county east and west, passing through Delavan, Elkhorn, and Springfield. A branch of this line runs north from Elkhorn to Eagle in Waukesha County. The Prairie du Chien division of the same road crosses the northwestern part of the county, passing through Whitewater. The main line of the Chicago & North Western crosses the extreme southwestern part, passing through Sharon. A branch of this road extends from Chicago to Williams Bay, running through Genoa Junction and Lake Geneva. The Milwaukee Electric Railway & Light Co. has an electric line extending from Milwaukee southwest to East Troy in this county. Another electric line, the Chicago, Harvard, & Geneva Lake line, extends from Harvard, Ill., to Fontana, at the west end of Lake Geneva. These railroad lines provide adequate transportation for both freight and passenger traffic in all parts of the county.

Public roads extend into all parts of the county, and most of these are kept in good repair. Under the present system of road development certain roads are being improved as State trunk highways. Some of these roads are constructed of concrete, while others are graded and crowned with crushed rock or gravel. A patrol system on all these roads insures their being kept in good repair. These State highways are being supplemented by county trunk highways, so that practically every community is reached by a branch of the improved highway system.

Nearly all parts of Walworth County are supplied with rural mail service and rural telephones.

The numerous towns and villages within the county provide a market for part of the farm produce, but the greater part of the produce is shipped to outside markets, including Milwaukee and Chicago. Numerous shipping organizations have been developed through the work of the farm bureau and county agent, and these have resulted in a marked improvement and more profitable handling of livestock and other products of the farm.

CLIMATE.

Nearly all of Walworth County is included within the Rock River basin, which is one of the eight climatic provinces of Wisconsin. This province has the longest growing season of any in the State, averaging about 170 days, which is as long as that of central Illinois, longer than that of central Indiana and Ohio, and about equal to that of central Virginia and that of central Maryland.

The mean annual temperature, as recorded by the Weather Bureau station at Delavan, is 46.1° F. During about seven summer days the thermometer may go as high as 90° F., and for about five winter mornings it may fall as low as 10° below zero or lower. The average rainfall, as recorded at Delavan, is 31.42 inches. The average date of the last killing frost in the spring at Delavan is April 26, and the average date of the first in the fall is October 10. This gives an average growing season at Delavan of 167 days, which is slightly shorter than the season for the whole province.

In the following table are shown the more important climatic data as compiled from the records of the Weather Bureau station at Delavan:

Normal monthly, seasonal, and annual temperature and precipitation at Delavan.

[Elevation, 920 feet.]

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1888).	Total amount for the wettest year (1909).
	° *F.*	° *F.*	° *F.*	*Inches.*	*Inches.*	*Inches.*
December	24.3	62	−27	1.50	2.56	3.45
January	18.8	59	−28	1.41	1.22	1.83
February	20.3	58	−26	1.31	.87	1.54
Winter	21.1	62	−28	4.22	4.65	6.82
March	31.8	82	−20	1.76	1.70	.73
April	46.7	88	15	2.69	2.41	7.60
May	57.4	93	22	3.88	4.39	3.42
Spring	45.3	93	−20	8.33	8.50	11.75
June	67.0	99	30	3.39	3.94	3.50
July	71.8	103	40	4.37	2.25	1.94
August	69.4	101	34	3.33	2.25	9.80
Summer	69.4	103	30	11.09	8.44	15.24
September	62.7	99	24	3.90	.69	3.58
October	49.1	89	2	1.89	1.79	1.05
November	34.3	77	−8	1.99	2.01	2.95
Fall	48.7	99	−8	7.78	4.49	7.58
Year	46.1	103	−28	31.42	26.08	41.39

The rainfall is fairly well distributed throughout the growing months when it is most needed. During the six months from April to September, inclusive, there is an average rainfall of more than 2.6 inches per month, and during five of these months the average rainfall is more than 3.3 inches.

The climatic variations within the county are slight, but they are most marked in connection with the marshes. It is well known that frosts frequently occur on marsh land when there is no frost on higher land. This is partly because the cold air which forms on the surface of all the ground at night tends to flow down and collect in low places but it is also the result of the fact that the loose, spongy soil of peat marshes does not conduct the heat received from the sun during the day downward. In consequence, the lower layers of soil do not become warmed in peat marshes as they do in more earthy soils.

and the little heat left in the surface inch or two of soil is rapidly lost at night by radiation, so that the freezing point is frequently reached on marshy soil when it would not be on soils that conduct the heat downward better during the day and so keep warm further into the night.

This difficulty with peat marshes can be overcome to a certain extent by heavy rolling, which, by compacting the soil, permits the heat to be conducted downward more readily. To a certain extent it will also become less in time, as the peat decomposes and takes on more of the character of muck. Nevertheless, it must be expected that marsh land will always be more subject to late spring and early fall frosts than high land. It may be stated as a general guide that killing frosts are as likely to occur on marsh land at any given point as on upland soil having good air drainage about 150 miles farther north; in other words, the marshes of Walworth County are as likely to have a frost which kills corn as early as are the upland regions of southern Shawano, Marathon, or Clark Counties. Frost may be expected on the marshes of Walworth County about two weeks earlier than on the upland soils. During most seasons corn can be matured on the well-drained marshes, but the danger from early fall frost should be kept in mind in the selection of crops for the marsh soils.

AGRICULTURE.

The agricultural history of Walworth County dates back to 1836, when the first farm operations were started in section 25, in Spring Prairie Town. During that year about 100 acres were plowed. Before the end of the year there were in the county about 100 head of cattle, 50 sheep, and a few hogs. The first farm operations were started on the prairie land, where practically no clearing operations were necessary. Early historical references indicate that farm operations were started early on the prairie in Walworth Town. Here the first plowing operations were on a rather extensive scale, and fields fully 2 miles in length were laid out.

The crops most extensively grown by the early settlers are indicated by the report covering the year 1839. During that year the production of wheat was 59,580 bushels; barley, 1,499 bushels; oats, 25,155 bushels; rye, 205 bushels; corn, 40,837 bushels; potatoes, 42,455 bushels; and hay, 3,624 tons.

The population in 1839 was 2,611. Because of the marked fertility of the soil and the success with which the early settlers met, settlement became quite rapid as soon as information concerning the bountiful crops reached the surrounding territory, and by 1842 the population had reached 4,618. By 1880 the population had increased to 22,632, and there was a corresponding increase in the acreage of land under cultivation. Since 1880 the population has remained nearly the same, as has also the number of farms in the county.

A considerable change has taken place, however, in the acreage of the different crops which have been and which are now being grown. In 1879 wheat occupied 26,080 acres, but the acreage was gradually reduced until in 1909 it was only 664 acres. During the war the acreage increased to a considerable extent. On the other hand, the acreage of corn while relatively large in the early history of the county, has always remained high, as has also the acreage of oats. The reduc-

tion in the acreage of wheat was partly due to the chinch bug and partly to low prices. As the acreage of wheat was reduced a more diversified system of farming was followed, and at the present time general farming is practiced in all parts of the county. In conjunction with general farming, the dairy industry has been developed to a marked degree, until Walworth County is among the foremost in the production of dairy products.

The following table gives the acreage and yield of the principal field crops grown in the county in 1879, 1909, and 1919, as reported by the United States census:

Acreage and production of leading farm crops in 1879, 1909, and 1919.

Crops.	1879.		1909.		1919.	
	Area.	Production.	Area.	Production.	Area.	Production.
	Acres.	*Bushels.*	*Acres.*	*Bushels.*	*Acres.*	*Bushels.*
Corn	40,332	1,571,987	58,036	2 574,290	31.361	1,384,196
Oats	26,305	1,018,578	34,293	1,255 061	39,524	1,068,079
Wheat	26,080	335,228	664	11,861	15,274	248,978
Barley	9,679	233,779	24,423	735,252	17,485	462,017
Rye	2,296	34,561	938	15.055	2,280	39,316
Potatoes		166,574	3,054	265,107	2,154	115,394
		Tons.		*Tons.*		*Tons.*
Hay[1]	54,108	78,769				
Timothy and clover			44,760	74,725	37,153	60,439
Alfalfa			1,538	4,724	3,696	7,882
Corn cut for forage			4,298	21,729	15,876	27,573
Silage crops					25,895	194,171

[1] Includes hay from both wild and cultivated grasses.

It will be noted that the most important crops from the standpoint of acreage are corn, oats, hay, barley, and wheat. In addition to these there are a number of other crops which are important but have a smaller acreage.

Corn occupies a larger total acreage than any other crop. In 1919 it was grown for grain on 31,361 acres and produced an average yield of 44 bushels per acre. The corn on over 25,000 acres was cut for silage and averaged 7½ tons per acre. In addition, over 15,000 acres of corn were cut for coarse forage. Corn is grown in all parts of the county and on all soil types, but under present conditions the Carrington and Waukesha silt loams are the most favored for corn production. When thoroughly drained, the Clyde silt loam is undoubtedly the best corn soil in the county, but at present only a small proportion of this type of land has been reclaimed by drainage.

Oats were grown on 39,524 acres in 1919 and produced an average yield of 27 bushels per acre. The yield of this crop varies greatly from year to year. The average yield for 1918 was 54 bushels, and in 1917 it was 51 bushels. Oats are grown on practically all of the well-drained soils and produce satisfactory yields, except on the extremely sandy soils. Named in the order of their importance, Swedish Select, Wisconsin Wonder, and Silvermine are the principal varieties of oats grown in Walworth County.

Timothy and clover were grown on 37,153 acres in 1919 and yielded an average of about 1.6 tons per acre. Of this acreage about 21,000 acres were in mixed timothy and clover, 11,000 acres in timothy alone, and 5,000 acres in clover alone. Marsh hay was harvested from about 5,000 acres, yielding 1.2 tons per acre.

While barley is grown to some extent, it does not cover one-half the acreage devoted to oats. In 1919 it occupied 17,485 acres, yielding a little better than 27 bushels per acre. In 1918 the acreage was over 29,000 and the yield was 39 bushels per acre, while in 1917 it was about 19,000, with 36 bushels as the average yield. Barley is grown in all parts of the county and does fairly well on a wide range of soils.

The wheat grown is nearly all spring wheat. In 1919 there were only 396 acres of winter wheat. The yield of spring wheat was only 15 bushels per acre, while the winter wheat yielded 24 bushels. In 1917 spring wheat yielded about 23 bushels per acre and winter wheat 24 bushels. Wheat is confined to the heavier soils of the county and does very well on the Miami and Bellefontaine silt loams. It is also grown extensively on the dark prairie types, but the quality of the small grains on the prairie types is not quite equal to that grown on the light-colored soils.

Rye is grown to a limited extent. In 1919 there were 2,280 acres in rye, yielding 17 bushels per acre. The yield the previous year was 24 bushels per acre. Rye is confined chiefly to the northern part of the county and is grown most extensively on types of sandy nature.

Potatoes are grown chiefly for home use, and as a rule very few are produced on a commercial scale. In 1919 they occupied 2,154 acres, which yielded only 53 bushels per acre. In 1918 the yield was 84 bushels per acre and in 1917 it was 99 bushels per acre. Potatoes make the best growth on the light-textured soils, although they are not confined to the sandy types by any means. One of the finest fields that was seen in the county was grown on Waukesha silt loam. In this field there were 100 acres, and the average yield was over 150 bushels per acre.

Alfalfa is coming to be a very important crop in Walworth County, although the present acreage is not large. In 1919 it was reported on 3,696 acres, which produced an average yield of over 2.1 tons. Alfalfa is grown in most parts of the county, but appears to do best on the Bellefontaine soils. These are very well drained and the structure of the subsoil is such as to permit the easy development of the large root system. The deep subsoil of these types also contains considerable lime carbonate which is favorable to the growing of alfalfa. This crop is also grown on the Miami soils with good success.

Peas are grown both for seed and for canning. In 1919 the peas on 148 acres were allowed to mature, and yielded an average of 15 bushels per acre. The peas from 417 acres were used for canning. There are several canning factories in the county, and these usually have branch viners scattered throughout a considerable territory. The farmers bring the peas to the viner, and the company hauls the shelled peas to the central canning plant from the viner. Where the farmers furnish the power and labor for running the viners, the vines are returned to the farmers. Where the canning company furnishes all of the labor and power, the vines are sold back to the farmers. The vines are usually put up in the form of silage and utilized as feed during the late summer and early fall. The varieties of peas grown for canning are the Alaska, which is a very early variety, Perfection, which is medium early, and Horsford Market Garden and Peerless, which

are late varieties. The yield of peas for canning usually averages from 1,500 to 1,800 pounds per acre, although yields of 3,000 pounds per acre are not uncommon. The average income is from $50 to $60 per acre, but returns of $100 per acre are reported.

Inoculation is practiced to some extent in growing peas, but the practice is not general. It is believed that inoculation will pay on all new land and will insure a better stand and bigger yield, and by many it is considered advisable to inoculate old land, especially where peas have not been grown before. It is poor policy to grow peas on the land more than two years in succession, and it is better to grow them for one year, and then follow with other farm crops, having peas as one member of the regular rotation. A rotation which is practiced to some extent with peas consists of hay land top-dressed with manure in the fall or winter and plowed in spring, corn one year, peas one year, followed by buckwheat, although the practice of growing buckwheat following peas is not very common. The next year the field is again devoted to peas, followed by small grain seeded with clover and timothy. By sowing at intervals using different varieties the period of harvesting is spread out over several weeks.

Peas are grown on a variety of soils, although the Bellefontaine and Miami silt loams doubtless give best results. On the dark-colored soils and those especially high in organic matter there is danger of the vines becoming too large. The Carrington silt loam is used rather extensively for peas in some parts of the county.

Sweet corn is also handled by some of the factories that can peas. The Evergreen is a medium early variety of sweet corn, and the Shoepeg is somewhat later. The average yield of snapped ears per acre runs from 2 to 3 tons. When the ears are snapped, the stalks are usually used for silage. The sweet corn is grown chiefly on the Carrington silt loam, but is not confined to this type.

Cabbage is one of the special crops. It was grown on 141 acres in 1919, the average yield being 5.2 tons per acre. Sugar beets were grown on 194 acres, flax on 55 acres, tobacco on 6 acres, and beans on 10 acres. Sorghum is grown to a very limited extent.

The production of fruit is limited chiefly to apples and bush fruits, including berries. There are few commercial orchards, but nearly every farm has a few trees on which apples are grown for home use. The bush fruits appear to do very well and are grown for home use in nearly all parts of the county.

The trucking industry has not developed to any marked extent, chiefly because of the distance to large centers of population. Some market gardening is done around the small towns, but only on a comparatively small acreage. Celery is grown on marsh land near Lakes Geneva and Como and shipped to outside points, as well as marketed at home (Pl. XXII, fig. 1).

A large proportion of the crops grown in the county are marketed in the form of dairy products or as pork or beef. Some hay is sold, but by far the greater proportion is fed on the farms, as is also the case with the barley, oats, and corn.

Dairying is a very important industry in the county. In 1919 there were 38,714 dairy cows, or 69 cows for each square mile in the county. Since the population numbers only 41 persons per square mile, there were 1.6 cows for each person. The cows of Walworth County on the average are milked for 341 days in the year. During

this time the production is 18.3 pounds per day per cow, or an annual production of 5,523 pounds of milk per cow. The total milk production in 1919 had a value to the producers of $6,606,958. Cattle of Holstein breeding are the most common in Walworth County and include a number of purebred herds that have a national reputation. A very high standard is being maintained in the dairying industry, the herds are kept free from tuberculosis by frequent tests, and many of the cows are sufficiently high in production to make them eligible to the advanced registry. While the Holstein is the leading breed, there are also numerous herds of Guernseys and a smaller number of Jerseys. A few herds of Brown Swiss are also giving a good account of themselves. In 1918 there were 18 butter factories and 4 cheese factories in the county. Considerable quantities of whole milk are shipped out, chiefly to Chicago.

While dairying is the leading industry in the county, other branches of the livestock industry are important. In 1909, according to the census, the value of animals sold and slaughtered approximated $1,500,000. This included about 55,000 hogs, 24,000 sheep, 23,000 calves, and 9,289 cattle.

Although the county is known as a dairy county, the production of beef cattle is not overlooked, and on a number of farms purebred beef cattle are being raised both for breeding purposes and for the block. Shorthorns are probably raised more extensively than other beef cattle, but there are some Herefords, Angus, and Red Poll. Red Polls and Shorthorns, however, may be classed as dual purpose. Some steers are brought in and fed for market also, although this practice is not extensively developed.

Hogs are raised on every dairy farm, and their value adds materially to the income on nearly every farm in the county. According to the census, there were 31,613 hogs in the county on January 1, 1920, with a value of $640,835. Among the leading breeds are the Duroc-Jersey, Berkshire, Poland-China, and Chester White.

Walworth County is not usually considered as a sheep county, yet on January 1, 1919, according to the reports of assessors, there were 22,395 sheep in the county, with an average value of $12 per head. The average number of sheep in the county is somewhat less.

Poultry is raised on practically every farm, and many of the farms have some income from this source, although very few specialize in poultry husbandry.

Horses have been depended upon in the past for all of the field work. During the last few years many farmers have purchased tractors and are doing much of the plowing and other heavy work with these machines. In most cases the tractors are proving satisfactory, especially on the larger farms, and are replacing some horse labor. The greater part of the farm work, however, is being done with horses. The census reported 13,378 horses and mules in the county in January, 1920. A few farmers make a specialty of breeding horses, but quite a number raise one or two colts each year and keep themselves supplied with work stock and frequently have a team to sell.

There is a very wide range of topography in Walworth County, varying from level to extremely rough and broken, and this has had some influence upon the development of agriculture and the types of farming which are followed in various sections. On the level prairies agriculture is very highly developed and practically all of the land is

highly improved. On the most broken areas, such as in the morainic belts, some of the land is too steep to be used for cultivated crops and has value only for grazing and forestry. Between these two extremes all gradations are found. The total area of land that is too steep for cultivation is comparatively small, but many of the fields which are now being tilled are subject to more or less erosion because of the steep slopes.

It is generally recognized by farmers that some soils are better adapted to certain crops than other soils, and there has been a gradual development along this line, so that the crops which are most extensively grown on the various types at present are those best suited to those soils. The fact must be kept in mind, however, that on any farm it is desirable and necessary to raise different crops in order that rotations may be practiced and the best methods of soil improvement followed. It is evident, therefore, that no one crop can be grown exclusively on the soil which may seem to be best adapted to that crop. It is generally recognized that the prairie soils are well adapted to corn production, but it is not considered advisable to grow corn on this land to the exclusion of other crops. The Clyde silt loam when thoroughly drained is one of the best corn soils in the State, yet even on this soil other crops should be grown in rotation with corn.

Such crops as rye and potatoes are grown more extensively on the sandy types than on the heavy soils. It is generally admitted that small grains will produce a higher quality on the light-colored heavy soils than on the prairie lands, and there is also less danger from lodging. Sugar beets have a slightly heavier sugar content when raised on the light-colored heavy soils than when grown on the prairie soils or the Clyde silt loam. However, the tonnage is usually larger on such soils as the Clyde silt loam, so that the total sugar yield is frequently larger on the dark-colored soil. There is still much to be learned, however, in regard to the adaptation of crops to the different soils, and it would be well for every farmer to make observations relative to the behavior of different crops and different varieties upon the various soils, and to be guided as far as practicable by the results of these observations.

The methods of farming followed in Walworth County at present are such as tend to the higher development of agriculture through the conservation of soil fertility. Gradually people are coming to recognize the importance of conserving the fertility and of following such methods as will permanently increase the productivity of the soil. Many farmers are taking advantage of the service offered by the Wisconsin State Soils Laboratory, which makes it possible for any farmer to have a careful examination made of the soils of his farm. The results of chemical analysis and physical examination of the farm provide the information that forms the basis of a report outlining methods for the improvement of soils. As a result of this line of work many farmers are beginning to use lime to correct the soil acidity and are using such fertilizers as are necessary to supply the elements the soil most needs. More care is being used in the conservation of stable manure, and this is being applied to the land as rapidly as it is being produced.

Usually more than half of the corn crop is put into the silo, and the remainder is usually husked; but a small part is harvested by hogs, the process being frequently referred to as "hogging off." Sometimes cattle are also turned into the field and allowed to harvest the crop in part; in such cases the cattle are usually followed by hogs.

Many farmers thresh their grain directly from the field, while others stack the grain and thresh later in the season, and some store the grain in barns and do not thresh until late in the fall.

Most of the farms in Walworth County are very well kept. The farm buildings are usually substantial. The barns are large, generally built on stone foundations, and kept painted and in good repair. (Pl. XXII, fig. 2.) The farmhouses are neat and attractive in appearance. The majority of the farms are equipped with silos, of which there were 1,793 in the county in 1918. Farm machinery of the most modern types is in common use throughout the county. Many tractors are in use, manure spreaders, hay loaders, side-delivery rakes, two-row cultivators, lime and fertilizer distributors, and other modern implements. The livestock upon the farms is, as a rule, well bred, and many herds are purebred. Highly developed and prosperous farms are the rule rather than the exception.

The rotation of crops which is probably most common consists of corn, followed by small grain, which is seeded to timothy and clover, after which hay is cut for one or two years. Corn may be grown on the same field for two years in succession, especially on the prairie soils, or the second year a part may be devoted to peas instead of corn. Small grains may also be grown for two years in succession. The greater part of the manure is applied to the corn ground, and this is frequently plowed in the fall. Sometimes the manure is spread in winter on plowed ground or on land which is to be plowed in spring. The question of rotations is receiving more careful attention now than in previous years, and most farmers follow some sort of a rotation, though not always the one best suited to their particular soils.

Stable manure is the fertilizer most commonly used, but the supply of this is not sufficient to meet the fertility requirements of the land. The supply is as large in this county and is as well conserved as in any part of the State, but even so the fertility requirements can not be maintained without supplementing the stable manure with other materials. As a result of the work of the State soils laboratory, it has been definitely established that many of the soils of the county are deficient in phosphorus. Since stable manure is not available in sufficient quantities to provide enough of this element it should be supplemented by fertilizers supplying phosphorus. Acid phosphate is the form most commonly recommended and is coming to be quite generally used. Wherever it is applied properly the results are nearly always satisfactory and very marked increases in yield are often obtained. On some of the soils the supply of nitrogen and organic matter is also limited, and to supply the nitrogen and phosphorus at the same time mixed fertilizers are needed, and their use is gradually increasing. In the census of 1920, 149 farms reported the use of commercial fertilizers, with an average expenditure of about $100 per farm reporting. Clover and other green crops are frequently plowed under for soil improvement, and this practice should be more common.

All of the black prairie soils are acid and need lime, and many of the light-colored soils also show varying degrees of acidity. Ground limestone is the form of lime most commonly used, and the practice of liming is gradually becoming more common. Many of the soils must be limed before clover or alfalfa can be grown successfully. Much of the killing out of clover and "clover sickness" is due to the acid condition of the soil.

Farm labor has been rather difficult to obtain in the last few years. With the development of manufacturing in Racine, Kenosha, Beloit, Janesville, and Milwaukee, there has been a gradual drawing away of labor from the farms. The highest wages were reached in 1920, when as much as $60 to $70 and in some cases even $100 per month was paid. In 1921 there was a marked decrease in the farm wages. The pre-war wage was usually from $35 to $50 per month for the best farm labor when hired by the year, and this frequently included the use of house and garden for married men. Day labor, of course, commanded a much larger wage, but was needed for only a part of the season. A higher grade of labor is required for raising purebred livestock than for grain farming.

According to the census of 1920, about 92 per cent of the land area of the county is included in farms, and 72.5 per cent of the farm land is classed as improved. The census reported 2,779 farms, with an average size of 118.8 acres.

In 1920, 66.2 per cent of the farms were operated by owners. This is a considerable reduction since 1880, when 86.4 per cent of the farms were operated by owners. Many farms in Walworth County, especially in the region of Lake Geneva and Delavan Lake, are owned by nonresidents, chiefly from Chicago, who have their summer homes in this region. Some of these are extensive and are operated by managers. Many of these places are very highly developed. The farms operated by tenants are rented both on the share and on the cash basis. The share received by the tenant is variable, depending on the amount of stock and equipment he furnishes. It usually ranges from one-third to one-half, but may be less where the owner furnishes all the stock and equipment.

There is a wide range in the selling price of land in Walworth County, owing to differences in the valuation of the land itself and also to location and improvements. Some of the best farms that do not have a location making them valuable as summer homes have a selling value of as much as $300 an acre, though this is considerably higher than the average for the farms in any community. The other extreme is found in the land within the extremely rough and hilly sections, where land can be purchased from $25 to $50 an acre. Between these extremes all variations in land values may be found. Much of the land near or adjoining the lakes has a higher selling price, because of its desirability for summer homes, being especially attractive to nonresident people who wish to combine farming with recreation. The average assessed valuation of farm land in Walworth County was $48.26 an acre in 1900, $69.38 in 1910, and $116.14 in 1920. The average value of all property per farm in 1880 was $5,030; in 1890, $7,000; in 1900, $8,928; in 1910, $13,265; and in 1920, $22,672.

FIG. 1.—CELERY ON DEEP PEAT NEAR LAKE COMO.

FIG. 2.—SUBSTANTIAL FARM BUILDINGS IN WALWORTH COUNTY. MANY BARNS ARE SURROUNDED BY STONE WALLS AND HAVE STONE MANURE CONTAINERS.

SOILS.[1]

The soil material of Walworth County, like that of a considerable area in southeastern Wisconsin, owes its accumulation to several distinct processes, including glacial, alluvial, and possibly loessial. To these may be added the accumulation and decay of vegetable matter and the formation of Peat.

The underlying rock formation in most of the eastern half of the county is the Niagara limestone. The western margin of this passes near the village of East Troy, through Elkhorn, and from there nearly south to the southern county line. Immediately west of this line is a belt from one-eighth to one-fourth mile wide, in which the Cincinnati shale forms the uppermost rock. Over the remainder of the county, which includes nearly all of the western half, the uppermost rock consists of Galena and Trenton limestone.

The surface of the county as a whole owes its general character to glacial action. Through the action of the ice sheet vast quantities of glacial débris were accumulated, and these were left as the ice sheet melted. Most of the soils of the county have been derived from this glacial débris. As the swollen streams carried quantities of this material away from the glacial ice fields, extensive alluvial deposits were formed. In many of the depressions and partly filled valleys large quantities of organic matter gradually accumulated through the growth and decay of water-loving plants, giving rise to the formation of peat soils. Over a considerable part of the county there is an extremely silty surface soil, which by some authorities is considered to be of loessial or wind-blown origin.

The glaciation which covered most of Walworth County is known as the late Wisconsin. Sharon Town, in the extreme southwestern corner of the county, was not covered by this glaciation, but appears to have been influenced by a much older ice sheet. The few stones and bowlders in this region are more thoroughly decomposed and the drainage ways more thoroughly established than in the region of more recent drift.

There is a marked variation in the depth of glacial drift over the underlying rock formations. From various well records the depth of the drift has been determined in a number of places. At Richmond the depth is about 230 feet; at Elkhorn, 213 feet; at Williams Bay, 405 feet; and at Delavan, 439 feet. In La Grange and Sugar Creek Towns the records of five wells, chiefly from the outwash plains, show that bedrock was reached at a depth of 230 to 235 feet. This variation in depth is accounted for by the presence of a preglacial valley extending across the county. In this valley the till in places is over 200 feet deeper than elsewhere. In Sharon Town the depth of the drift is variable also, although this is in the region of the older

[1] Walworth County is adjoined on the east by Kenosha and Racine Counties, on the north by Jefferson and Waukesha Counties, and on the west by Rock County. There appear to be some differences in the mapping along the boundaries between these counties. This is due to changes in the correlation and the greater amount of detail worked out in mapping the soils in the more recent work. The soils mapped in the Miami series in Jefferson and Waukesha Counties are mapped in the Bellefontaine, Miami, and Conover series in Walworth. Similarly, the Clyde soils of those areas are now separated into the Clyde and Maumee series. Where there are any differences in the names of the soils along the county lines, the names used in Walworth County should be extended to abutting soils in the areas surveyed earlier.

glaciation. A number of rock outcrops occur, while, on the other hand, the depth extends locally to 200 or 250 feet. Very little of this region has a shallow mantle of glacial material over the rock.

Ninety per cent or more of the gravel found in the drift consists of limestone material. Mixed with this, however, are varying proportions of crystalline-rock gravel which has been carried a long distance by the glacial ice. In the morainic areas the material carries a very high percentage of stone, gravel, and bowlders, and in deep cuts some rough stratification can be seen. The ground moraine areas or till plains are less stony, and a large proportion of the stones present are angular or subangular, showing that they have not been transported for any great distance. The outwash plains and terraces consist of stratified beds of sand and gravel mantled with a thin layer of sandy or silty material.

Probably for a long time after the glacial period there was very little forest growth on any of the lands of the county. Marsh and prairie conditions became well established in time. Later tree growth took possession of the areas where conditions were least favorable for maintaining a heavy sod of grasses, as in the rougher morainic and sandy areas. As time went on the forest encroached more and more upon the prairie areas of the smoother till plains and along streams and slopes until a large proportion of the uplands and terraces was covered with a medium to heavy tree growth. In the main the tree growth held to the better drained areas, but some of the wet lands became forested, including the overflow lands along the streams and the swampy depressions where deep peat deposits have accumulated. As found by the early settlers, the forest areas with fair to good drainage were supporting a scattering to dense growth of hardwood consisting mainly of oak, maple, and hickory, and on less well drained areas oak and hickory, with some ash, elm, and soft maple. Some of the areas of Peat had a dense growth of tamarack or a mixture of alder and willow with scattering tamarack. Prairie grasses thrived over the open lands, except the low-lying flats and depressions that were in a condition of true marsh.

The soils of Walworth County have resulted from the changes brought about by weathering of the several classes of material laid down during and since glacial times. Naturally they are quite varied in their color and other characteristics. The soils developed under forest cover where fair to good natural drainage has been established are light in color, having gray to brown surface soils and gray and brown mottled to yellow and reddish-brown subsoils. The weathered zone extends to a depth of 2 to 3 feet in the more recent glacial areas, and to 4 feet or more in the old glaciation in the southwestern corner of the county, and enough leaching has taken place to remove all free carbonates, the surface soils being in an acid condition. The soils that have developed under prairie conditions vary from black surface soils over mottled yellow and gray subsoils in the poorer drained areas to dark-brown surface soils over yellowish-brown evenly oxidized subsoils in the best drained areas. As with the light-colored soils, all free carbonates have been leached from the weathered zone, which extends to depths ranging from 2 to 4 feet, and in most areas the surface soil shows at least a slight acid reaction. The marsh and swamp soils are characteristically black or very dark brown over gray to bluish-gray and yellowish-brown mottled subsoils, or,

in the case of the organic soils, they have a black mucky to brown peaty character to depths of 1 to 3 feet or more. The soils developed in the marshy areas generally are not in an acid condition, although as a rule they contain very little if any free carbonate, except in the substratum.

Taking into account the different processes by which the soil-forming material was accumulated and the different physiographic positions occupied, the soils may be arranged in four main groups: (1) Soils of the uplands derived from ice-laid deposits; (2) soils of the terraces and outwash areas derived from old water-laid sediments; (3) soils of the flood plains consisting of recent alluvium; and (4) soils from organic remains or peaty accumulations. In the first three groups the soils may be divided into light and dark soils. For the purpose of mapping, the soils are classified into series and types. Each soil series consists of soil types that have a common origin and are similar in color, structure, topography, and drainage. The types in a series differ from each other in the texture of the surface soil.

The light-colored soils developed under the most perfect conditions of drainage in the uplands are classed in the Bellefontaine series, except the very gravelly kamey areas classed in the Rodman series and the light sandy areas in the Coloma series. Under slightly less perfect drainage conditions we have the Miami series, and in areas with deficient drainage the Conover series is developed. The light-colored terrace soils include a corresponding range of conditions which give the Fox and Plainfield series in the best-drained areas and the Homer series in the areas with deficient drainage. The typical Fox soils correspond in color to the Bellefontaine soils.

In the dark upland group the soils developed under good drainage conditions belong to the Carrington series, and under poor drainage to the Clyde series. In the terrace or old sedimentary group the Waukesha and Maumee series represent the well-drained and poorly drained soils, respectively. All of the recent alluvium is classed in the Wabash series, although the Genesee series is represented to a small extent. The organic soils are mapped as Peat.

The surface soils in the Bellefontaine series are grayish brown to brown, and the subsoil is reddish brown or yellowish brown in the upper part and reddish brown below. The subsoil is heavier than the soil, and rather compact and tough. At a depth of 2 to 2½ feet it passes into a lighter, more friable material, this being stony and gravelly till, only slightly weathered and carrying a high percentage of limestone material. In this series the surface soils are neutral or only slightly acid. The surface is undulating to strongly rolling and rough, and drainage is well established.

In the Miami series the surface soils are brownish gray to grayish brown, and the subsoil is yellowish brown and usually shows some rusty iron streakings and specks. The subsoil is heavy and tough to a depth of 30 to 48 inches, grading below into a more friable material which is moderately to strongly calcareous. The surface soils are in an acid condition. The topography is undulating to gently rolling, and the drainage is fairly good, but slower and not so perfect as on the Bellefontaine soils.

The Conover soils are gray to brownish gray with a rather dark cast, changing to a lighter gray with some mottling in the subsurface. The subsoil is mottled gray, yellow, and brown, heavy in texture and

tough in structure, giving way at depths of 2 to 3 feet to calcareous till like that underlying the Miami soils. The surface soils and the upper subsoils have a strong acid reaction. The topography is flat to very gently undulating, and the natural drainage is deficient.

The Coloma series is characterized by grayish-brown surface soils and a yellowish-brown light sandy subsoil. The unweathered parent material below depths of 2½ to 3 feet usually is light and sandy and carries little or no limestone material. The surface is undulating to strongly rolling, and the natural drainage is good to excessive.

The Rodman series is developed on the very gravelly parts of the moraines with very irregular and broken topography and the rougher parts of the terraces, where a shallow layer of brown soil has formed over the loose gravel deposits. The drainage is excessive.

The Fox series has grayish-brown to brown surface soils and a yellowish-brown to slightly reddish brown subsoil, heavier than the soil in texture and somewhat compact and tough in structure, resting upon stratified beds of gravel and sand at a depth of 20 to 48 inches. The substratum contains a high percentage of limestone material. The surface soil is in an acid condition. The topography is level to gently undulating, and the drainage is good.

The surface soils in the Carrington series are dark brown to black and the subsoil is yellowish brown to brown. The subsoil is somewhat heavier and more compact than the soil to a depth of 24 to 48 inches, giving way below to moderately friable calcareous till like that underlying the Miami series. All free carbonates have been removed from the soil section, and the surface layer gives an acid reaction. The topography is gently rolling, and the natural drainage is good.

The types of the Plainfield series have grayish-brown sandy surface soils and a yellowish-brown sandy subsoil and substratum. The surface soils are in an acid condition, and no free carbonates occur in the soil section. The surface is level to undulating. The drainage is good to excessive.

The Homer series is characterized by brownish-gray to gray surface soils and a mottled gray, yellow, and brown, heavy, tough subsoil, resting at a depth of 30 to 36 inches upon a more friable stratified material which is calcareous. Usually there is a light-gray, ashy, or mottled layer between the soil and the heavier subsoil. This and the surface soil give strong acid reactions. The surface is flat, and the natural drainage is poor.

The types of the Waukesha series correspond in their profile characteristics to those of the Carrington series, except that the substratum beginning at a depth of 24 to 48 inches is more distinctly sandy and gravelly, consisting of stratified beds of calcareous sand and gravel. The topography is level, and is characteristic of the smoother terraces and outwash plains.

The surface soils in the Clyde series are black, and the subsoil is gray to bluish gray mottled with yellow and yellowish brown. The subsoil is little if any heavier than the soil in texture, but is generally plastic in the heavier types, becoming more friable in the unweathered material reached at depths of 30 to 40 inches. The substratum of the Clyde soils is calcareous glacial débris like that under the Miami and Carrington series. The surface soils are not acid. The Clyde soils occur in flat and depressed areas in uplands where a marshy or semiswampy condition existed.

In the Maumee series the surface soils are black, and the subsoil is gray mottled with yellow and brown. The subsoil may be as heavy as the soil or light in the upper layer with heavier material in the lower subsoil or substratum. The material below 36 inches is calcareous, while the soil section itself may be slightly acid or calcareous enough to effervesce in mineral acids. The Maumee soils occupy the poorer drained parts of the levees and old lake plains.

The Wabash series includes dark-brown to black soils with gray mottled subsoils. They occur on the alluvial plains of streams and are subject to frequent overflows. Small areas of light-colored soils were included which would have been mapped in the Genesee series if they had been more extensive.

The organic soils mapped as Peat range from black and finely divided to brown and coarsely fibrous.

The following table gives the actual and relative area of the types mapped:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Bellefontaine silt loam (Miami)[1]	76,608	21.4	Maumee silty clay (Clyde)	4,096	1.1
Miami silt loam	39,552	12.2	Fox fine sandy loam	3,648	1.0
Shallow phase	4,416		Bellefontaine fine sandy loam (Miami)	3,456	1.0
Waukesha silt loam	3,200	9.2	Carrington loam	960	.9
Deep phase	29,696		Gravelly phase	2,048	
Clyde silt loam	32,576	9.1	Waukesha loam	1,792	.7
Peat	28,032	8.1	Gravelly phase	896	
Shallow phase	1,216		Maumee fine sandy loam (Clyde)	448	.5
Bellefontaine loam (Miami)	3,136	7.2	Heavy phase	1,472	
Gravelly phase	22,464		Coloma fine sand	1,792	.5
Carrington silt loam	24,256	6.8	Clyde silty clay loam	1,728	.5
Fox silt loam	6,016	6.6	Bellefontaine stony loam (Miami)	1,664	.5
Heavy-subsoil phase	17,536		Plainfield fine sand	1,280	.4
Conover silt loam (Miami)	6,464	2.7	Homer silt loam (Fox)	1,216	.3
Dark phase	3,392		Maumee silty clay loam (Clyde)	192	.2
Fox loam	2,624	2.5	Light-subsoil phase	512	
Gravelly phase	6,272		Waukesha fine sandy loam	448	.1
Maumee silt loam (Clyde)	8,704	2.4	Maumee loam (Clyde)	256	.1
Rodman gravelly loam	7,232	2.0	Waukesha fine sand	128	.1
Wabash silt loam	6,208	1.9			
Light phase (Genesee silt loam)	768		Total	358,400	

[1] The names in parentheses are those used in the report published by the State.

BELLEFONTAINE STONY LOAM (MIAMI).

The Bellefontaine stony loam does not have the uniform characteristics of a distinct soil type. It includes areas of stony soils with extremely rough and irregular morainic surface features similar to those of the Rodman gravelly loam. This stony loam, however, differs from the Rodman gravelly loam in having a heavier covering of soil material over the underlying gravel. The surface soil ranges in texture, from place to place, from a heavy sandy loam to a silt loam. It is not very gravelly but is generally extremely stony, except in very small local areas. The subsoil is chiefly reddish brown in color, ranges in texture from loam to gritty compact clay loam, and extends to depths of 20 to 30 inches or more before beds of loose gravel are encountered.

This stony loam occurs chiefly in rather large bodies in the morainic region in the northwestern part of the county, particularly in La Grange Town. A few smaller tracts are in other morainic parts

of the county. This type has about the same origin as the Rodman soils. Its surface is extremely rough and broken, so that cultivated crops could not well be grown. The natural drainage is good, but seldom excessive, because the soil above the gravel is sufficiently deep to retain moisture.

The forest growth consists mainly of red oak, white oak, and hickory, with some poplar and birch. The type makes good grazing land for the entire season where cleared of timber and brush. This is in direct contrast with the Rodman gravelly loam, where grazing is limited to the spring and early summer.

Owing to the uneven surface of this type and the consequent danger of erosion the land should not be plowed, but should be retained in permanent pasture. It can be used to good advantage in connection with land of more even topography, keeping the smooth land for cultivated crops and the stony loam areas for grazing. Where least rolling this soil could be utilized to some extent for cultivated crops if the stones were removed. The soil when cleared of stones would be especially well suited to alfalfa, because of its high lime content and crumbly, gritty subsoil. The proportion of the type that could thus be improved is very small.

BELLEFONTAINE FINE SANDY LOAM (MIAMI).

The Bellefontaine fine sandy loam has a surface soil of brown or brownish-gray fine sandy loam extending to a depth of 8 to 10 inches. This is underlain by material of about the same texture, although somewhat lighter in color, which grades at 18 to 24 inches into reddish-brown loam, sandy clay, or clay loam. The lower subsoil is generally more or less gravelly below 30 inches.

The Bellefontaine fine sandy loam is confined chiefly to the northern row of towns. It is of rather small extent, occupying a total of about 5 square miles. The type occurs mainly on knolls, drumlins, and slopes, and the surface and internal drainage is good. On nearly all the type modern farm machinery can be used, and practically all of it is under cultivation,

This soil has been derived from glaciated limestone material which still contains considerable lime. The surface soil has been leached to some extent and in places is in an acid condition.

The original forest consisted chiefly of oak and maple. The crops grown most extensively at present are rye, oats, barley, clover, and alfalfa. Soy beans and potatoes and some peas and melons are raised. Cucumbers are grown as a special crop in some localities.

This soil warms up early in the spring, is easy to cultivate, responds well to fertilizers, and is considered a fair soil. It is better adapted to truck crops than to general farming, however, and where situated so that transportation is satisfactory it should be devoted to this line of farming.

BELLEFONTAINE LOAM (MIAMI).

The surface soil of the Bellefontaine loam consists of a brown or light grayish brown friable loam extending to a depth of 6 to 8 inches. This is underlain by material of about the same texture and some-

what lighter color. At 14 to 18 inches this material passes into reddish-brown sandy clay or gritty clay loam, which rests upon gravelly till at a depth of 24 inches or more.

The type is somewhat variable, and the texture of the surface may range from a heavy sandy loam to a light silty loam. The subsoil is looser and more open than the subsoil of the Bellefontaine silt loam and is also more variable, in places containing considerable sandy material. However, it contains enough clay to make it retentive of moisture.

The Bellefontaine loam is confined chiefly to the towns of East Troy, Troy, and Lyons, although some patches occur in other parts of the county. Only a few areas contain more than a quarter section, and the total area does not exceed 5 square miles.

The surface ranges from undulating to strongly rolling, with numerous knolls and ridges. Some of the slopes are rather steep, but most of the type would be classed as gently rolling. Because of the surface features and the open structure of the subsoil, the type is well drained. The steeper slopes are somewhat subject to erosion, but not more so than on the Bellefontaine silt loam.

This soil has been derived from limestone material ground largely from the underlying limestone by glacial ice. The subsoil contains much lime carbonate, chiefly in the form of small pebbles and powdered rock, but the surface soil has been leached to a large extent, and over a considerable part of the type an acid condition has developed.

The type originally was in forest, chiefly of oak, hickory, and maple. By far the greater part is under cultivation and is used for a wide range of crops, including corn, oats, barley, rye, soy beans, clover, alfalfa, and timothy. Clover and alfalfa have been more uniformly successful on this type than on most other soils of the county. This is due chiefly to the fact that the soil contains considerable lime carbonate and is also well drained. The system of farming followed, including crop rotation, cultivation, and fertilization, is practically the same as on the Bellefontaine silt loam. Methods of improvement on that type are also applicable to the loam soil.

Bellefontaine loam, gravelly phase.—The gravelly phase of the Bellefontaine loam varies in texture. It is mainly a brown gravelly loam with a deep-brown or reddish-brown, tough, gritty clay loam subsoil, which carries considerable gravel and passes at depths of 18 to 24 inches into gravelly or somewhat sandy calcareous till. The texture of the surface soil ranges from a gravelly sandy loam to a gravelly silt loam, and in some places where the surface has been eroded the exposed surface is a gravelly clay loam. A few small areas that are practically gravel free are included with the type.

The Bellefontaine loam, gravelly phase, is found in every town in the county. The smallest area is in Sharon Town, and the most extensive occurrence in Richmond, Sugar Creek, and Lafayette Towns. The surface ranges from rolling to broken and hilly, and in places the slopes are rather abrupt. Over most of the type, however, modern farm machinery can be used. Because of the uneven surface features and the loose character of the subsoil, the natural drainage is good and sometimes excessive.

The material forming this soil was worked up chiefly from the underlying rock by glacial ice and formed into terminal and recessional moraines. The type contains a very large proportion of limestone material, and the subsoil is very high in carbonates. The surface soil is seldom acid and for this reason is well suited to the growing of clover and alfalfa.

The native timber consisted chiefly of oak and hickory. There are still a number of woodlots remaining, but most of the merchantable timber has been cut.

The greater part of this type is in improved farms, but considerable areas are kept for permanent pasture because of the uneven surface and rather steep slopes. Where it is farmed the general farm crops of the region are grown. These include corn, small grain, and hay. Alfalfa is grown on this soil and does very well because of the large content of lime. The rotation and methods of cultivation followed are similar to those practiced on the Bellefontaine silt loam. In the improvement of this soil, the methods recommended for that type will apply. Care should be taken to keep the steep slopes covered with growing crops as much as possible, and where there is danger of erosion the land should be kept in permanent pasture.

BELLEFONTAINE SILT LOAM (MIAMI).

The surface soil of the Bellefontaine silt loam is a grayish-brown, mellow silt loam 6 to 8 inches deep. This is underlain by material of about the same texture and a slightly yellowish brown color which in places changes to a slightly reddish brown material and extends to a depth of 12 to 18 inches. Below this depth it gives way to the subsoil proper, which is a reddish-brown compact silty clay loam grading at a depth of 18 to 24 inches into a friable gravelly or gritty loam or clay loam. Locally the material below 30 inches is rather gravelly, but the gravel is almost always mixed with considerable clay so that the subsoil is fairly retentive of moisture. The subsoil of this type differs from the subsoil of the Miami silt loam in containing considerably more sandy and gravelly material, in having a more crumbly structure, and in being more thoroughly oxidized. The supply of organic matter in the surface soil is rather low, which accounts for the light color.

The surface soil is slightly gravelly in places and locally contains some fine sand. The depth of the surface soil also varies somewhat with the irregularities in topography, and on many slopes the surface has been sufficiently eroded so that the reddish-brown subsoil is exposed. These reddish-brown spots are characteristic of the Bellefontaine silt loam, and are common in many cultivated fields. Some crystalline-rock bowlders occur on the surface and through the soil section, but as a rule they are not present in sufficient numbers to interfere with cultural operations. Where they were originally most numerous they have in most cases been removed from the fields.

The Bellefontaine silt loam is the most extensive soil in Walworth County and occurs in every town. The largest tracts are in the towns of Linn, Geneva, Spring Prairie, and Lafayette. Sharon Town in the southwestern part of the county has less than any other. Where

this soil occurs, its continuity is broken by areas of the Bellefontaine loam and its gravelly phase, and in places by areas of low-lying, poorly drained land.

The surface ranges from undulating to gently rolling, and in some places it is rolling and slightly hilly. (Pl. XXIII, fig. 1.) Owing to the uneven surface and the open character of the subsoil, the natural drainage is good. Water moves through the soil section freely, and there is sufficient clay present to make the soil retentive of moisture. Most of the type is subject to erosion, as indicated by the exposure of the subsoil on knolls and slopes and the formation of small, shallow gullies. Where the wash from the slopes has accumulated along the lower slopes, the soil is considerably deeper than the average.

This type has been derived from glaciated limestone material ground from the underlying limestone. With this has been mixed a small proportion of material from the region of crystalline rocks farther north, as evidenced by the small content of granitic gravel and stone. Although the material is mainly from limestone, the surface soil has been leached to a considerable extent and in many places is now in an acid condition. The deep subsoil, however, still contains considerable lime carbonate.

The original forest growth consisted of several varieties of oak, hickory, and maple. Most of the merchantable timber has been removed, but there are still a few woodlots that contain saw timber. If properly conserved, these woodlots would furnish fuel for the use of farmers for a long time.

The Bellefontaine silt loam is one of the most important soils of Walworth County, and nearly all of it is included in highly improved farms. It is a good general farming soil, and all of the general crops grown in the region are produced on this type. Corn, oats, barley, wheat, and hay are the most important crops. Sugar beets are raised to a considerable extent, and canning peas are grown very successfully. This soil is probably better adapted to alfalfa than any other of the extensive types in the county, and a large majority of the alfalfa fields are located upon this type. This is doubtless due to the open character of the subsoil and to the fact that there is generally considerable lime in the deep subsoil.

The crop rotation most commonly followed consists of small grains, hay, and corn. The small grains are seeded with alfalfa or clover and timothy. Hay is usually cut for one and sometimes two years, then the land is broken and planted to corn, which generally occupies the land for one year, although on some farms it is grown for two years. The available manure is usually applied to sod before plowing for corn. When alfalfa is grown it occupies the land for three to five years, or as long as the stand is satisfactory.

For the improvement of this soil, the supply of organic matter should be increased by supplementing the stable manure with green-manuring crops, preferably legumes. Chemical analyses made by the State soils laboratory show that this soil is deficient in phosphorus. The use of acid phosphate has been found profitable for most of the general farm crops. Since this type is acid in places, every field should be tested to determine the need of lime and the amount that should be applied.

MIAMI SILT LOAM.[2]

The surface soil of the Miami silt loam in its typical development consists of a brownish-gray, smooth, friable silt loam extending to a depth of from 10 to 12 inches and becoming somewhat lighter in color in the lower part. The soil is remarkably free from gravel and coarse material, and very few bowlders occur on this type. The subsoil is a slightly yellowish-brown silt loam passing at about 14 or 16 inches into a yellowish-brown or light-brown, smooth, compact silty clay loam. This extends to a depth of 30 to 36 inches, where it grades into more porous, gritty, calcareous till, which is somewhat gravelly in places.

The surface soil is uniform in texture but varies slightly in color owing to the large accumulation of organic matter on some of the nearly level or slightly depressed areas. There is also some variation in the depth of the soil section over gravelly till. This may range from about 20 inches to 4 feet, with an average of about 3 feet. The areas where the depth to gravelly calcareous material ranges from 20 to 30 inches are similar to the Miami silt loam, shallow phase.

The large areas of the type in Sharon Town are in the old glaciation. Here the surface soil to a depth of 8 to 10 inches consists of a brownish-gray, smooth, friable silt loam, rather low in organic matter. When dry the surface material has an ashen appearance. The surface is entirely free from gravel, only an occasional bowlder is found, and the soil section contains very little sand. The upper subsoil consists of a yellowish silt loam which becomes heavier and grades into a silty clay loam at a depth of 14 to 16 inches and this in turn becomes a silty clay at about 2 feet. At a depth of 3 feet or more the subsoil shows a slight mottling or streaking with rusty iron stains. The subsoil is heavy, compact, and rather tough, and is almost entirely free from sandy and gravelly material. The tough silty clay loam to silty clay subsoil extends to a depth of 4 to 6 feet where it passes abruptly into unassorted gravelly sandy material. This gravelly material contains much lime, but it is less calcareous than the substratum of the typical Miami silt loam. Tests indicate that the entire soil section from the surface down to the gravelly material has varying degrees of acidity. The content of organic matter varies slightly, being greatest along the bottoms of slopes and in slight depressions.

The Miami silt loam is found in several portions of the county, though in most places it does not occupy areas of more than 5 or 6 square miles in one body. Some of the more important areas are in the northeastern part of Walworth Town, in the central part of Geneva Town, and Lafayette, Richmond, Linn, and Sugar Creek Towns. The variation of the type in the older glacial area occupies about 70 per cent of Sharon Town and extends over into the western part of Walworth Town. This is by far the most extensive development of the type.

The surface is very gently undulating to gently rolling, and most of the slopes are long and smooth. As a rule the natural surface drainage is good. In a few places, however, where the surface is

[2] State name is Miami silt loam, deep phase.

nearly level, tile drains can be established to advantage, and on a number of the gentle slopes tile drainage would be beneficial because of the heavy character of the subsoil.

The slopes along some of the stream courses in the old glacial area are more abrupt than typical. This steeper slope variation is of limited extent and minor importance. It varies considerably from the typical soil. Gravelly material comes closer to the surface in places, and gravel is frequently found on the surface. In places erosion has removed surface soil and cut gullies in some of the hillsides.

The native forest on this soil consisted of oak, hickory, maple, and some elm and cherry.

Practically all of this type is included in farms, and nearly all of it is highly developed. It is an excellent soil, and a good seed bed can usually be prepared without difficulty. The yields average well with those on the prairie land. The chief crops grown are corn, small grains, hay, sugar beets, and peas for canning. The large areas in Sharon Town are devoted chiefly to general farming and dairying and the chief crops are corn, small grains, and clover.

Barnyard manure is the only fertilizer generally used, although recent tests indicate that the soil responds well to commercial fertilizers containing phosphorus, as the soil is somewhat deficient in this element. Small amounts of nitrogen combined with the phosphorus also give excellent results. The crop rotation most commonly followed consists of corn, followed by small grain seeded to clover and timothy. Hay is cut for one or two years, and sometimes the land is pastured for one season before it is plowed for corn. Corn may be raised for one or two years, when the land is again sown to small grain.

In the improvement of this soil the content of organic matter should be increased by using the available manure, and supplementing this with green-manure crops, of which legumes are, of course, best. All fields should be tested for acidity, and where they have an acid reaction ground limestone should be applied. A phosphate fertilizer can be used to good advantage, and tests indicate that acid phosphate is the most profitable form to use. If rock phosphate is used, it should be applied with stable manure, so that the decay of the manure will aid in making the phosphorus more readily available to growing plants.

While this soil is now producing very good crops, its productiveness can be materially increased through liming and the application of acid phosphate. Because of its high selling value, every effort should be put forth to increase the crop yields to the maximum and at the same time maintain the fertility of the soil. The rougher slopes should be protected by being kept in permanent pasture. Where forested the steep slopes should be kept as woodlots.

Miami silt loam, shallow phase.—The Miami silt loam, shallow phase, consists of a gray to brownish-gray mellow silt loam underlain at 8 to 10 inches by a subsurface layer of yellow or mottled gray and yellow compact silt loam or silty clay loam, which passes at a depth of 18 to 24 inches into brown or reddish-brown, compact, gritty clay loam. At about 30 inches or more the subsoil changes to gravelly sandy clay or gravelly sandy loam, or a mixture of sand and gravel. A small quantity of crystalline gravel occurs on the surface in some places.

This soil is mapped most extensively in the vicinity of Elkhorn in the towns of Lafayette, Sugar Creek, Delavan, and Geneva. It is here associated with the Conover and Miami silt loams and occupies slight knolls and swells in the areas of Conover silt loam. The surface is undulating to very gently rolling. The natural drainage is somewhat better than on adjoining Conover soils, but not as good as on the Bellefontaine soils.

The material forming this soil has practically the same origin as the Miami silt loam, and the deep subsoil is calcareous. The surface soil in places shows acidity.

Most of the phase is improved farm land and is devoted to the growing of cultivated crops. A part of this soil, however, is still in forest, mainly of red oak, white oak, hickory, and elm, and is devoted to pasture. The chief crops are corn, oats, barley, and hay. Where the farms consist mainly of Conover or Miami silt loam, with a small proportion of the shallow phase of this type, alfalfa is being grown. It is claimed that this phase is better adapted to alfalfa than the Conover silt loam or the typical Miami silt loam. The methods of improvement suggested for the Miami silt loam will also apply to the shallow phase.

CONOVER SILT LOAM (MIAMI)[3].

The surface soil of the Conover silt loam is a mellow gray silt loam, about 8 inches deep, the lower part of which may be somewhat mottled. Below this depth it grades through 3 or 4 inches of yellowish or mottled yellow and gray silty clay loam into a subsoil of mottled yellow, plastic silty clay. The subsoil becomes strongly mottled with increasing depth, showing drab, gray, red, and yellowish mottlings below 24 inches, and soft concretions of dark-brown iron-bearing material. The lower subsoil becomes decidedly plastic and impervious. Mottled gravelly sandy clay or sandy loam is found locally in the lower part of the 3-foot section, but the presence of this material does not appear to improve internal drainage to any marked extent.

The Conover silt loam is most extensive in the vicinity of Elkhorn. It occurs chiefly in the towns of Lafayette, Sugar Creek, Delavan, and Geneva. None of the areas are large, but in this region they are rather numerous and make up from 20 to 25 per cent of the total area of certain sections.

The surface is flat or very gently undulating, and the soil occupies a position intermediate between the Miami silt loam and soils of the Clyde series. In many low spots small areas of Clyde silt loam are surrounded by this soil. Because of its position and its heavy subsoil, the type has deficient natural drainage and it is cold, wet, and backward in the spring.

The material forming this soil has been derived from glaciated limestone till, the same as the Miami silt loam. Leaching has not been carried to as great an extent, however, and the lower part of this soil is highly calcareous.

All of the Conover silt loam is included in farms, and part of it is devoted to the raising of general farm crops. Yields, however, are rather uncertain and usually low. Because of its backward condition

[3] State name is Miami silt loam, poorly drained phase.

and rather poor drainage, the type is devoted chiefly to hay and pasture. The native growth on this soil consists chiefly of hickory, oak, some ash, and soft maple.

Drainage is the most important feature in the improvement of this soil. When drainage has been supplied, more organic matter should be incorporated. This soil generally does not constitute entire farms and usually is associated with some higher lying, better drained land; it is therefore not difficult to utilize it in its present condition, since it supplies good pasture for the greater part of the year.

Conover silt loam, dark phase.[4]—The surface soil of the Conover silt loam, dark phase, consists of a gray or dull-gray silt loam, which may be slightly mottled in the lower part, and extends to a depth of about 10 inches. The subsoil is a mottled gray and yellowish silty clay loam grading at 18 to 24 inches into a mottled drab and yellow tough silty clay. When wet the surface soil is dark gray, but not as dark as the lighter variations of the Clyde soils under the same moisture conditions. When dry this soil has an ashy appearance. The heavy subsoil extends to a depth of 4 to 6 feet or more, where it rests upon the gravelly and sandy glacial material underlying this entire region.

The Conover silt loam, dark phase, is confined to the southwestern part of Walworth County, almost entirely within the town of Sharon. It occurs in rather small areas of a few acres to one hundred acres or more, and is generally distributed throughout this town. Its total area is about 5 square miles.

The phase has a flat or gently sloping surface and generally occurs between the lower slopes of Miami silt loam and the Clyde silt loam. It has the same relation to the Miami silt loam and Clyde silt loam in the region of old glaciation as the typical Conover has to the Miami and Clyde silt loams in the late Wisconsin drift. It differs from the typical Conover soils in having a slightly darker soil or more highly mottled subsoil and in the greater depth to calcareous material. It is more like the Nappanee soils as mapped in Indiana. It occurs bordering the low land adjacent to streams and slightly depressed areas around the headwaters of drainage courses.

The surface drainage is rather slow, and the heavy subsoil causes poor internal drainage. Water frequently stands on the lower lying parts for some time in the spring and after heavy rains. Because of its inadequate drainage this soil is cold and wet and consequently late in warming up in the spring.

The material forming this soil doubtless has the same origin as the variation of the Miami silt loam mapped in Sharon Town. The surface material is somewhat loesslike, and may be in part of wind-blown origin, while the deep subsoil which is gravelly, is derived from the pre-Wisconsin drift. The surface soil is free from gravel and coarse material, contains no lime carbonate, and is at present in acid condition. The underlying gravelly till is well supplied with limestone gravel, is high in lime carbonates, and is not acid.

The original forest consisted chiefly of white or bur oak, elm, ash, and hickory. Only a small part at present is in forest in the form of scattering woodlots. Most of the merchantable timber has been removed, but there are still some trees that would make considerable lumber and others that would provide only cordwood.

[4] State name is Carrington silt loam.

The phase is used largely for hay and permanent pasture. Grains are next in importance, with corn occupying the smallest acreage. Owing to the unsatisfactory drainage conditions, the yields of cultivated crops are frequently low. In the development of this type the acidity should be corrected, the land should be thoroughly drained, and the supply of organic matter and phosphorus should be increased.

The table below gives the results of mechanical analyses of samples of the soil, subsurface, and subsoil of the typical Conover silt loam:

Mechanical analyses of Conover silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
313329	Soil, 0 to 8 inches	1.0	2.2	1.1	3.6	10.6	70.5	10.9
313330	Subsurface, 8 to 24 inches	.9	8.2	4.8	9.3	12.6	52.3	11.9
313331	Subsoil, 24 to 40 inches	.7	7.5	4.7	9.3	10.5	55.1	12.4

COLOMA FINE SAND.

The Coloma fine sand consists of a grayish-brown loamy fine sand or loose fine sand, underlain at 6 to 8 inches by yellowish fine sand. Locally at depths of 30 to 40 inches it contains enough clay to make the sand slightly sticky, and in places the lower subsoil also contains small quantities of fine gravel.

The Coloma fine sand occurs chiefly in La Grange Town. The topography varies from gently rolling to rolling, and owing to the loose subsoil and the rolling surface, the natural drainage is excessive.

This type has been formed from glacial material probably derived largely from limestone but in part from sandstone. This soil has been leached considerably since its first deposition, and practically all of the carbonates that may have been present originally have been leached from the surface soil, and an acid condition has developed.

The native forest growth consists of a rather scattering growth of oak, hickory, some poplar, and hazel brush. A large part of the type is cleared and in farms and is being used for the production of the ordinary farm crops. Its productivity, however, is rather low, and the general appearance of farmsteads is inferior to those on heavier soils. The type is better suited to the production of special truck crops than to general farming, and where it is favorably located for shipping it should be devoted to trucking. The type responds readily to fertilizers and is in need of mineral plant-food elements and also nitrogen and organic matter. With the use of mineral fertilizers, good stands of clover can be secured, and by turning these under the organic content can be increased. Where the supply of manure is small, mineral fertilizers should be used. They may also be used to good advantage to supplement the manure and thus make it cover a larger acreage.

RODMAN GRAVELLY LOAM.

The Rodman gravelly loam includes areas that are rather variable in texture and have a broken and rough topography. The surface soil generally consists of a brown or dark-brown loam, silt loam, or

fine sandy loam, containing a considerable amount of gravel and extending to a depth of 4 to 6 inches. This is frequently underlain by from 4 to 8 inches of extremely gritty clay loam, which is underlain at from 8 to 12 inches by beds of stratified gravel. In places the layer of sand and gravel is considerably less than this, and in others somewhat deeper.

The type occurs chiefly in La Grange, Whitewater, Lyons, and Troy Towns, and in a number of small scattering areas in other sections. The areas are all irregular and are associated chiefly with soils of the Bellefontaine series. In some places stones appear upon the surface but these are usually not numerous.

The surface of the Rodman gravelly loam is extremely rough and broken, being made up largely of kames, eskers, and potholes. In many places the land is too steep for cultivated crops. Because of the uneven surface and the extremely gravelly nature of the subsoil, the natural drainage is excessive and the type suffers from drought practically every year.

The material forming this soil has been derived largely from the underlying limestone through the grinding action of glacial ice. Over 90 per cent of the gravelly material consists of limestone. Much of it has been deposited by water underneath the ice. This soil is not acid, but contains large quantities of lime carbonate.

The native vegetation consisted chiefly of scrubby oak and hickory, and a considerable part of the type is still covered by a scattering growth of scrubby oak. The type is used chiefly for grazing and supplies good pasture during the spring and early summer. As soon as hot weather sets in, however, the grass dries up and is of little value for the remainder of the season. This soil should be kept for grazing, and the timber now standing should be retained in order to prevent erosion.

CARRINGTON LOAM.

The surface soil of the Carrington loam has an average depth of 10 inches and consists of dark-brown loam which contains considerable organic matter. The upper subsoil is a chocolate-brown loam which becomes yellowish brown at about 16 to 18 inches and grades into a sandy clay loam at about 20 inches. This gritty subsoil extends to a depth of more than 3 feet. Small quantities of gravel and occasional bowlders are found in places on the surface. The subsoil may also contain considerable gravel and stones.

This type is somewhat variable and ranges in texture from fine sandy loam to silt loam. Where the silty variation occurs, the soil is deeper than typical. These variations give the type a somewhat spotted appearance, which differentiates it from the typical silt loam.

The Carrington loam is of small extent in Walworth County. It is found chiefly in the northwestern part of the county associated with the Carrington silt loam.

The Carrington loam has been derived from limestone material which was deposited by the late Wisconsin ice sheet. The glacial material is made up almost entirely of limestone, but the surface has been leached to such an extent that it is now in an acid condition. This acidity, however, does not extend to as great a depth in the loam soil as in the silt loam.

The original vegetation was almost entirely prairie grass. Practically all of the type is under cultivation and in improved farms. About the same crops are grown as on the silt loam, but it is not quite as desirable a soil as the silt loam. Methods of improvement recommended for the silt loam will apply also to the loam. The most important lines of improvement are the correction of acidity and supplying the element phosphorus.

Carrington loam, gravelly phase.—The surface soil of the Carrington loam, gravelly phase, consists of about 8 inches of dark-brown or nearly black loam which in places is somewhat sandy and gravelly. This is underlain by a chocolate-brown gravelly loam which becomes yellowish with increasing depth. The subsoil is variable. In places the material below 18 inches is a gravelly clay loam which may extend to a depth of 3 feet or more. In other places it is more sandy. Locally the lower subsoil grades into unassorted clay, gravel, and sand, and in a few places into beds of sand and gravel within the 3-foot section.

The Carrington loam, gravelly phase, is associated with the Carrington silt loam and occurs scattered through practically all of the prairie regions, mainly in tracts of a few acres to 40 acres, although there are some larger tracts. It is a soil of minor importance from an agricultural standpoint.

The phase usually occupies gravelly ridges or knolls, and many of these are conspicuous as they form a contrast to the gently undulating silt loam. The natural drainage is sufficient and in places excessive.

The material forming the Carrington loam, gravelly phase, is of glacial origin and occurs chiefly as kames and eskers. The gravelly material is almost entirely limestone, and the subsoil is well supplied with carbonates. The surface soil, however, is usually slightly acid. The degree of acidity is less than on any of the other Carrington soils. For this reason alfalfa will grow on the gravelly phase of the Carrington loam, whereas, on the Carrington silt loam it is sometimes difficult to secure a good stand of alfalfa without lime.

The greater part of the phase is under cultivation and is devoted to the general farm crops of the region. The yields are lower than on the Carrington loam or silt loam, and the phase as a whole is not as highly prized.

CARRINGTON SILT LOAM.

The surface soil of the Carrington silt loam consists of a dark-brown to a black silt loam which grades into a chocolate-brown silt loam and extends to a depth of 10 to 14 inches. It has a large supply of organic matter, is smooth and friable in structure, and contains very little material as coarse as a fine sand. The subsoil consists of a brown or yellowish-brown silty clay loam which becomes somewhat heavier with depth and in places lighter in color at about 2 feet. The lower subsoil is generally a clay or silty clay loam and grades at 30 to 36 inches into yellowish-brown gravelly sandy clay or gravelly clay loam. In many places there is a sharp line between the extremely silty material and that which contains coarser particles of sand and gravel. The areas in section 6 of Sharon Town and section 13 of

FIG. 1.—ROLLING TOPOGRAPHY OF THE BELLEFONTAINE SILT LOAM. THIS IS A VERY GOOD ALFALFA SOIL.

FIG. 2.—GENERAL FARM VIEW ON THE WAUKESHA SILT LOAM.

Darien Town differ from the typical in having greater depth to the calcareous substratum, being about 4 feet. These areas are in the old glaciation.

There is some variation in the soil. On some of the slopes and knolls the color is lighter than typical, being more brown than black, the soil may be somewhat loamy and slightly gravelly, and the underlying gravelly clay material is nearer the surface than typical. This variation is due to the partial removal of the surface soil by erosion. Along the lower parts of slopes there are local accumulations of wash from the higher land, and as a result the soil is somewhat deeper than usual and may contain more organic matter than typical. Such variations, however, are of small extent, and the slopes that are subject to destructive erosion are not numerous on this type.

The Carrington silt loam is one of the important and extensive types in Walworth County, and occurs in rather large areas in several localities. A considerable prairie in the southern part of Spring Prairie Town extends over into the eastern part of Lafayette Town. A second prairie region is in Delavan Town, and a third in Linn and Bloomfield Towns. Other smaller tracts of the type occur in various parts of the county.

The surface ranges from level or nearly level to gently rolling. The natural surface drainage is adequate, and the water moves through the soil in a satisfactory manner, but the drainage can hardly be considered rapid. In fact there are a few places with nearly level surface where tile drains would be beneficial.

The Carrington silt loam has been formed mainly from limestone material worked up by the most recent glaciation. The extremely silty covering of the type may be due to the presence of wind-blown material deposited over the unassorted glacial débris. The large content of organic matter in the soil is due to the growth and decay of a rank prairie vegetation. The gritty lower subsoil contains considerable limestone material in the form of small pebbles, but the surface material has been leached to such an extent that practically all of the lime carbonate has been removed, and the soil is now acid. The degree of acidity is variable, but all parts of the type show some acidity.

The Carrington silt loam is one of the most highly prized agricultural soils in Walworth County. The native vegetation consists of prairie grass, with fringes of trees along stream courses and bordering other soils. Probably 95 per cent of the type is in improved farms and is highly developed. It is devoted to dairying and general farming, corn being one of the most important crops. The most common rotation consists of corn for two years, followed by small grain, usually for two years, when the land is seeded to clover and timothy. Hay is cut for one or two years before the land is again plowed for corn. Stable manure is usually applied to the corn ground. Because of the extremely silty nature of the soil, it works up readily into a mellow seed bed. The difficulty experienced in getting satisfactory stands of clover is attributed chiefly to the acid condition of the soil.

The first and most important step in the improvement of the Carrington silt loam is to correct the acidity. This will not only make possible a better stand of clover, but it will also increase the yields of practi-

cally all the general farm crops. This type is also deficient in phosphorus, and the manure should be supplemented with a phosphate fertilizer. Even on farms where much stock is kept and concentrated feeds are used, the deficiency in the phosphorus supply will not be corrected. Acid phosphate, which is probably the best source of phosphorus, may be applied along with the manure when the manure is used as a top dressing; it may be drilled in with the grain by means of a fertilizer attachment, or applied in the hill when the corn is planted. About 200 pounds per acre in the row or 300 to 400 pounds broadcast is a good application. Potassium is present in sufficient quantities so that, as long as a good supply of decaying organic matter is maintained, enough potassium will continue to become available to meet the needs of general farm crops.

Farms on the Carrington silt loam have a selling value of $200 to $300 an acre, depending upon their location and improvements.

FOX FINE SANDY LOAM.

The surface soil of the Fox fine sandy loam is a dull-brown fine sandy loam to sandy loam, 8 inches deep. The subsoil is a yellowish or light-brown fine to medium sandy loam, which grades at 20 to 24 inches into compact sandy clay loam or sandy clay. This material may continue to depths of more than 36 inches or it may pass into stratified sand and gravel within the 3-foot section. The type varies in texture and in places consists of a loamy fine sand or sand underlain by an upper subsoil of about the same texture, which grades into the heavier subsoil before the beds of sand and gravel are reached.

The Fox fine sandy loam in its typical development is confined to the northern half of the county and is located mainly in La Grange, Troy, and East Troy Towns, the largest area being in sections 11, 12, 13, and 14 in the town of La Grange. The areas of medium texture occur in sections 1, 19, 20, 21, 28, 31, and 32 of Troy Town and sections 6 and 21 of East Troy Town.

A variation included with this type consists of a surface soil of brown or grayish-brown fine sandy loam, with an average depth of 12 inches, and a subsoil of mottled yellowish and grayish sand, which extends to depths of 5 to 7 feet, where it is underlain by dense, heavy, calcareous clay having a pinkish or drab color mottled with yellow and gray. This heavy clay is similar in texture and structure to the subsoil of the Superior series of soils as found in other sections of the State. The depth to the heavy clay is variable but is seldom less than 4 feet.

This sandy-subsoil variation occurs chiefly as slight swells and low knolls associated with soils of the Maumee series in the towns of Whitewater and La Grange. The surrounding land is for the most part poorly drained and low. This soil occupies slightly better drained areas, and although lying somewhat higher than the adjoining land, its drainage is somewhat deficient.

The surface of the Fox fine sandy loam is generally level, but locally it is slightly undulating. Where the type is lightest in texture, it has in places been influenced slightly by wind action. Potholes are rather numerous and tend to make the surface irregular where there are several close together. Because of the texture of the soil and its underlying coarse material, the natural drainage is good.

The material giving rise to this type is of alluvial origin. It was deposited in its present position largely by streams coming from beneath the great ice sheet and occurs as outwash plains or stream terraces. Most of the material has come from the grinding up of the underlying limestone by glacial ice, but has to some extent been modified by the action of water.

The type was originally in forest consisting chiefly of maple, hickory, and oak. Practically all of it is improved and devoted to the production of all farm crops suited to the region. The soil is especially well adapted to truck crops. It is easy to cultivate, warms up early in the spring, and responds readily to fertilization. The soil can be improved by increasing the content of organic matter, and the use of phosphate fertilizers will doubtless be found profitable. When an acid condition exists, it should be corrected by the use of ground limestone before an attempt is made to grow alfalfa. Inoculation may also be necessary before seeding alfalfa.

Most of the sandy subsoil variation near Whitewater is under cultivation and devoted to general farming and truck crops. It is best suited to the growing of truck crops and is so situated that it could well be used for gardening. Because of its sandy nature, it would probably require the use of commercial fertilizers or large quantities of manure to maintain fertility.

FOX LOAM.

The Fox loam consists of about 8 inches of grayish-brown loam, underlain by light-brown to yellowish-brown loam, which changes at about 18 inches to a compact yellowish-brown clay loam. Stratified sand and gravel generally occur at a depth of 24 to 30 inches. The surface soil is somewhat variable and ranges in texture from silt loam to fine sandy loam. Wherever these variations were extensive enough they were separated and mapped with the type to which they belong.

The Fox loam occurs in small areas rather widely distributed in East Troy, Troy, and La Grange Towns. The surface is level or very gently undulating, except in a few places where it is gently rolling, owing chiefly to potholes and terrace slopes. Because of the underlying coarse material the drainage is good.

This type is of alluvial origin and occurs on outwash plains or terraces deposited in their present position largely through the action of glacial streams. Most of the material consists of glacial débris derived from the underlying limestone and modified to some extent by flowing water.

Practically all of the Fox loam is cleared and under cultivation and included in improved farms. The uncleared land is in forest, chiefly of maple, oak, and hickory. The chief crops grown are corn, oats, rye, clover, and timothy. Alfalfa also does well on this soil because the underlying material contains much limestone. The methods of cultivation, fertilization, and crop rotation followed are practically the same as on the Fox silt loam, and methods for the improvement of that type will apply equally well to this soil.

Fox loam, gravelly phase.—The Fox loam, gravelly phase, is rather variable in texture, but is consistently gravelly both on the surface and through the soil, with the exception of a few small areas north of East Troy, where the surface is free from gravel. The surface soil

generally is a brown gravelly sandy loam or gravelly silt loam, extending to a depth of about 8 inches, underlain by a more or less gravelly subsoil, heavier in texture than the surface soil and ranging from a compact loam to a silty clay loam. Beds of loose porous sand and gravel are reached at depths of 18 to 30 inches.

The Fox loam, gravelly phase, occurs chiefly on slopes bordering lakes and streams, and on slopes bordering potholes and other depressions. The surface is irregular, but seldom steep enough to interfere with the use of modern farm machinery. Because of the sloping nature of the surface, erosion has removed part of the surface soil in many places, leaving the heavier subsoil exposed. The natural drainage of the surface and subsoil is good and in places excessive.

The material forming this type has been derived from glacial débris which was reworked and deposited by streams as outwash plains and terraces. The gravelly material consists largely of limestone, consequently the subsoil is never acid and the surface soil is seldom acid.

The native growth consists chiefly of oak, with some hickory and a little maple. Probably half of the phase is used for crop production, while the remainder is in forest or permanent pasture. The crops grown are the same as those produced on other soils of the region. The yields, however, are somewhat lower than those obtained on the loam and silt loam types. Alfalfa is probably the most promising crop because of the abundance of lime in the soil. In addition alfalfa forms a protecting cover that helps to prevent erosion.

The chief need in the improvement of this soil is the addition of organic matter. Lime is seldom needed, but phosphate fertilizers may give profitable returns.

FOX SILT LOAM.

The surface soil of the Fox silt loam consists of about 10 inches of light-brown floury silt loam which becomes a grayish brown when thoroughly dry. This grades through several inches of yellowish-brown or buff, compact silt loam into yellowish-brown silty clay at a depth of from 12 to 14 inches. This material is uniform and is comparatively free from coarse particles. Stratified sand and gravel is generally encountered at depths ranging from 18 to 30 inches.

The Fox silt loam occurs in small areas in 14 of the 16 towns in the county, mainly, however, in the northern half of the county. The largest single area is in sections 17 and 20 in the town of Troy.

The surface of this type is flat or very slightly undulating. Potholes and terrace slopes form variations in the topography in a few places. On some slopes the surface soil has been removed by erosion, thereby exposing the heavier subsurface material, which accounts for the soils being heavier on these slopes than elsewhere. In places the gravelly subsoil is also exposed on these slopes. The underlying coarse material insures good drainage.

The type is derived mainly from limestone material ground up by glacial ice and modified to some extent by the action of water. It occurs on outwash plains or stream terraces deposited in their present position largely by streams coming from beneath the glacier.

The Fox silt loam was originally in forest, consisting chiefly of maple, oak, some hickory, and various other hardwoods. Nearly all of it has been cleared and placed under cultivation and is now in

highly improved farms. It can be classed with the types of the highest agricultural value in the county. The chief crops grown are corn, oats, barley, clover, and timothy, with a gradually increasing acreage of alfalfa.

The gravelly material in the subsoil is calcareous, but the surface soil in places has become leached to a great extent and acidity has developed. This acidity is seldom strong, and in many places alfalfa can be grown without the use of lime. However, tests should be made on each field before alfalfa is grown and lime applied where needed.

The methods of farming on this type are practically the same as on the Miami and Bellefontaine silt loams. For the improvement of this soil the content of organic matter should be increased, either by applying stable manure or plowing under green-manure crops. The type usually responds well to phosphatic fertilizers, and tests should be made to determine the exact need in this respect. Limestone should be applied wherever the soil is acid.

Fox silt loam, heavy-subsoil phase.[5]—The surface soil of the Fox silt loam, heavy-subsoil phase, has an average depth of 12 inches, and consists of a gray to brownish-gray floury silt loam. This grades through a zone of 3 to 6 inches of compact silt loam into a compact yellowish-brown silty clay, which continues without change to a depth of over 3 feet. Stratified sand and gravel are generally encountered at depths of 40 to 60 inches, but are seldom reached within the 3-foot soil section.

There are some minor variations in the soil, chiefly around potholes where the surface soil is somewhat more loamy than typical and not quite so deep. Around some of these places gravel occurs in small quantities on the surface.

The Fox silt loam, heavy-subsoil phase, is confined almost entirely to the northern half of the county and occupies a total area of approximately 27 square miles. The largest tracts occur in Richmond, La Grange, Troy, and East Troy Towns. The village of Troy Center is situated on an area of about 2 square miles of this soil.

The surface is for the most part level, but locally it is somewhat irregular from the presence of kettle basins and potholes. In some places these are sufficiently numerous to give the phase a slightly rolling topography. Because of the underlying sand and gravel, the drainage is usually fair to good, but where the heavy layer is deepest the drainage is slightly deficient, and in such places a slight mottling may occur in the lower subsoil.

This soil has been derived from glacial material, chiefly from ground-up limestone which was deposited in the form of outwash plains or stream terraces. The deep subsoil is not acid, but the surface soil in places has developed a slight degree of acidity.

The phase was originally in forest, consisting chiefly of maple, hickory, and oak. Most of it has been cleared and placed under cultivation and is now in highly improved farms. It is one of the important agricultural soils of the county. It is devoted chiefly to general farming and dairying, the principal crops grown being corn, small grains, clover, and alfalfa. The system of farming is practically the same as on the Miami and Bellefontaine soils, and the yields are very similar. Farms on this soil have a selling value of $150 to $200 an acre.

[5] State name is Fox silt loam, deep phase.

PLAINFIELD FINE SAND.

The surface soil of the Plainfield fine sand is a light-brown fine sand 6 inches deep. The subsoil is a yellowish fine sand, which becomes somewhat lighter in color and extends to a depth of over 3 feet. Locally the lower subsoil is coarser in texture and may grade into beds of stratified sand and gravel.

This type occupies a total area of 2 square miles in the northern tier of towns and occurs chiefly in La Grange Town. The surface is level to gently undulating, and the natural drainage is good to excessive.

Small areas occur in Whitewater and La Grange Towns that are not typical. They are low lying and have a heavy clay stratum at shallow depth, which interferes with the underground drainage. The surface soil is a brown or grayish fine sand underlain by a yellow or grayish and sometimes grayish and brown mottled fine sand, which extends to a depth of 4 to 8 feet.

The greater part of this type is cleared of the native cover, consisting chiefly of scrubby oak, and is devoted to the ordinary farm crops of the region. Yields, however, are considerably lower than on the heavier types. Corn, rye, small grains, and hay are the chief crops, but the type is better suited to special crops, such as potatoes or garden truck, than to general farm crops. The soil works up easily, warms up early in the spring, and responds readily to fertilization. More organic matter should be added, and complete fertilizers will give good results on this land.

HOMER SILT LOAM (FOX).[6]

The surface soil of the Homer silt loam consists of 6 to 8 inches of dull-gray, friable silt loam. The subsoil is a light-gray, whitish, or mottled yellow silt loam, passing at 12 to 18 inches into plastic, mottled, gray or yellow silty clay, which at a depth of about 3 feet grades into calcareous stratified material or into mottled gray or yellow calcareous silt loam.

The Homer silt loam is confined almost entirely to the northern half of the county and is most extensive in the towns of Troy, Sugar Creek, and Richmond. The largest area is in sections 6 and 7 of Richmond Town. None of the areas exceed one-fourth square mile in extent, and many of them cover only a few acres. The type is associated chiefly with the soils of the Fox series.

Included with the Homer silt loam are some areas of the Homer loam, in which the surface is a gray or light-brown loam, about 8 or 10 inches deep, underlain by a subsoil of light-gray or slightly mottled yellow and gray sandy loam or loam, which changes at 18 to 24 inches to a compact impervious sandy or silty clay. Beds of stratified sand and gravel are reached at a depth of 36 inches or more. The Homer loam occurs in the northern half of the county in patches of a few acres to 40 acres. It is associated with the Fox series and may be considered as being a poorly drained phase of the Fox loam. In places it is associated with the Maumee silt loam, but is lighter colored than the Maumee and occupies a slightly higher elevation on outwash plains. The surface is level or nearly level, and the natural drainage is deficient.

[6] State name is Fox silt loam, poorly drained phase.

The surface of the Homer silt loam is level and is slightly lower than the Fox soils with which it is associated. Because of this slightly lower position and the heavy nature of the subsoil, the drainage is somewhat deficient. The chief difference between the Homer silt loam and the Fox silt loam is that it has poorer drainage and consequently a strong mottling in the subsoil.

This type and the included Homer loam have been formed from glacial-outwash material like that from which the Fox soils were derived. The subsoil contains considerable lime in places, but the surface has been leached and locally it is slightly acid.

The original forest growth consisted chiefly of elm, soft maple, hickory, and some oak. Most of the merchantable timber has been removed, but there are a few scattering trees in places.

Most of the type is under the plow and used for corn, hay, and small grains. The part not cultivated is mainly in permanent pasture or meadow. The type is rather cold and wet in the spring and becomes dry and hard in the early part of the summer. It is quick to show the effects of a dry spell, since the water does not move freely through the compact subsoil. Crop yields on this type are somewhat lower than on the Fox soils. Better drainage is usually the most important need in improving the type. When this has been established, slightly more organic matter should be added to the soil. Phosphatic fertilizers will be found profitable for most of the farm crops.

WAUKESHA FINE SAND.

The Waukesha fine sand consists of dark-brown to nearly black fine sand or loamy fine sand, 8 to 12 inches deep, underlain by light-brown or yellowish-brown fine sand, which usually grades into stratified sand and gravel at depths of less than 3 feet.

The type is of very small extent and is confined chiefly to the town of East Troy. The surface ranges from level to gently undulating, and the natural drainage is somewhat excessive. The soil is of alluvial origin and occurs on terraces or outwash plains. It is practically all under cultivation, being devoted to corn or to the general farm crops of the region. The yields are slightly better than those obtained on the Plainfield fine sand, but are lower than on the other types of the Waukesha series.

WAUKESHA FINE SANDY LOAM.

The surface soil of the Waukesha fine sandy loam consists of 12 inches of dark-brown to nearly black fine sandy loam which becomes somewhat lighter in color with depth. The subsoil is a chocolate-brown fine sandy loam, which becomes more yellow with depth and usually grades at about 14 or 16 inches into a sandy or gritty clay loam. Beds of sand and gravel are reached at depths of 24 to 36 inches. The type is subject to some variation, and the heavy layer in the subsoil is lacking in places.

This type is confined chiefly to small scattering areas in Troy, East Troy, and La Grange Towns. The surface is level. Owing to the underlying sand and gravel, the natural drainage is good. The soil is derived from glaciated limestone material occupying outwash plains and stream terraces, and was developed under a native vegetation consisting chiefly of prairie grasses.

Practically all of the Waukesha fine sandy loam is included within highly developed farms and is devoted to the production of the usual farm crops of the area. The average yields are lower than those on the silt loam. The type is well adapted to special crops and could well be devoted to truck farming where the location is favorable for shipping. The soil should be improved by correcting the acidity, and it will respond well to fertilizer high in phosphorus.

WAUKESHA LOAM.

The surface soil of the Waukesha loam is a dark-brown to black loam 8 inches deep. This grades into a chocolate-brown subsoil, which becomes heavier and more compact with depth and takes on a yellowish-brown color below 14 inches. At a depth of 2 feet there is usually considerable gritty material, and beds of sand and gravel are reached at depths ranging from 20 to 30 inches.

This soil is of comparatively small extent and therefore of minor importance. The largest area is in sections 20 and 21 in East Troy Town. Small patches occur in Troy and La Grange Towns. None of the areas are of more than 1 square mile in extent, and most of them are much smaller. The surface of the Waukesha loam is level. The underlying sand and gravel insure good natural drainage.

The soil has been derived largely from glaciated limestone material, deposited in the form of outwash plains and terraces. Although the lower subsoil contains much limestone material, the surface soil is acid and in need of lime.

All of this type occurs within the prairie regions. Most of it is included in improved farms and is devoted to the production of the ordinary farm crops. Being somewhat lighter in texture, it is better suited to special crops than the heavy silt loam of this series, but the trucking industry has not been developed.

The methods of cultivation, fertilization, and crop rotation followed are practically the same as on the silt loam, and recommendations for the improvement of that type will also apply to this soil.

Waukesha loam, gravelly phase.—The Waukesha loam, gravelly phase, has the same relation to the Waukesha soils as the Fox loam, gravelly phase, has to the light-colored terrace and outwash soils. The surface soil for the most part consists of a dark-brown to nearly black sandy or silty loam, extending to a depth of about 8 inches. This is underlain by a gravelly subsoil that is somewhat heavier in texture than the surface soil and in places becomes a silty clay loam. Beds of loose sand and gravel are reached at depths ranging from 18 to 30 inches.

The gravelly phase occurs chiefly in Richmond, Darien, and Sugar Creek Towns. In a number of places it occurs within areas of Waukesha silt loam, deep phase, as terrace escarpments or bordering pothole depressions. It also occurs along the slopes leading to streams. This soil has been formed from glacial-outwash material derived from the limestone till which covers the region.

The surface is somewhat irregular or sloping, but seldom steep enough to interfere with the use of modern farm machinery. Because of the loose character of the soil and the sloping surface, the natural drainage is good to excessive.

The greater part of the Waukesha loam, gravelly phase, is included in farms and is devoted to the general farm crops of the region. It is probably better suited to alfalfa than the Waukesha silt loam

because the gravelly subsoil contains much lime within reach of the roots of the plants. Where the surface soil has a dark color it is for the most part slightly acid. Where the surface soil has been eroded so as to expose the heavy subsoil, there is considerable lime near the surface. Erosion should be prevented on this soil; this may be done by keeping the surface covered with growing crops as much as possible.

WAUKESHA SILT LOAM.

The surface soil of the Waukesha silt loam consists of dark-brown to black silt loam, grading below 6 or 8 inches into chocolate-brown compact silt loam, which extends to a depth of 8 to 12 inches. The subsoil is a light-brown silty clay, grading into a gritty silty clay or compact sandy clay. At depths of 24 to 30 inches this passes abruptly into beds of sand and gravel. The soil for the most part is uniform, but in a few places the surface soil contains more fine and medium sand than typical. The depth to the sand and gravel is variable, but is seldom less than 18 inches. Where it is 3 feet or more, the land has been classed with the deep phase of the Waukesha silt loam.

The Waukesha silt loam is not extensive. The largest tract is in the town of Spring Prairie. Smaller patches are in Troy, East Troy, and Walworth Towns. Most of these areas are small, and many of them consist of long narrow belts in slight depressions or on gentle slopes.

The typical Waukesha silt loam occurs as outwash plains or stream terraces. The surface is level or very gently undulating. Because of gravel and sand in the lower subsoil, the natural drainage is good. In places the type occurs on the border of potholes or on terrace slopes. In such cases the soil is usually lighter in color than typical, and because of erosion there may be some gravel on the surface. In a few places the type occurs in long, narrow, shallow depressions through which water flows during wet seasons.

The material forming the type has been derived in part from glaciated limestone material which has been reworked by the action of water. The beds of gravel are largely of limestone material, and the lower part is not acid. The surface of the soil, which is extremely silty, may be in part of wind-blown origin. Its dark color is due to the accumulation of organic matter. This surface material has been thoroughly leached and is now in an acid condition.

Waukesha silt loam is classed with the land of high agricultural value in Walworth County. The native vegetation was chiefly prairie grass, with a few trees along the streams. The type is almost entirely under cultivation and included in highly improved farms. (Pl. XXIII, fig. 2.) It is used for the production of corn, small grains, hay, and some special crops. Potatoes are grown to a considerable extent on the area in Spring Prairie Town, and some onions are also grown with success. Because of the underlying beds of gravel and sand, the type is somewhat better drained than the deep phase and can usually be worked a little earlier. When the acidity is corrected by liming, alfalfa gives satisfactory yields, and it is gradually being grown more extensively on this soil. The correction of acidity is the first and most important step in the improvement of this type. Phosphate fertilizers give excellent results and can be used with profit on all crops.

Waukesha silt loam, deep phase.— The surface soil of the Waukesha silt loam, deep phase, consists of 10 to 14 inches of dark-brown to black silt loam. The subsoil is a deep-brown or chocolate-brown silty clay loam, which becomes heavier and more compact with depth until at 24 inches it generally is a yellowish-brown silty clay. At about 30 inches some gritty material occurs in places in the subsoil and at depths of 40 to 60 inches beds of sand and gravel are reached. The phase as a whole is uniform, except for a slight variation in depth to the sand and gravel and a slight mottling here and there in the lower subsoil.

The deep phase of the Waukesha silt loam has a total area of approximately 46 square miles and is an important soil in Walworth County. It occurs chiefly in three areas, one in Walworth Town, one in Darien and Richmond Towns, and one in La Grange and Sugar Creek Towns. A number of smaller patches are scattered throughout the western half of the county. There is comparatively little of this phase in the eastern half of the county.

The surface of the Waukesha silt loam, deep phase, is level or only slightly undulating. Because of the deep heavy soil material and the level surface, the natural drainage, while fair, is not quite as free as that of the typical soil. In some localities tile drains might be beneficial, especially where the soil is deepest over the underlying sand and gravel.

The material forming this type was deposited by water as terraces or outwash plains. The gravelly substratum was derived largely from the underlying limestone, but the extremely silty surface covering may in part be wind blown. The dark color is due to the accumulation of organic matter under a native vegetation consisting chiefly of prairie grasses. The deep subsoil is calcareous, but the lime has been leached from the surface soil and practically all of the type is more or less acid and needs lime.

The Waukesha silt loam, deep phase, is one of the most highly prized soils of Walworth County and includes some of the finest farms in the region. The leading crops grown are corn, small grains, and hay. Corn is one of the most important crops and does better on this soil than on most of the other soils in the county. The small grains yield well, but usually the quality of the grain is not so good as that raised on the light-colored upland soils. Sugar beets are also grown with good results. Alfalfa can be successfully raised if the soil is limed, and the acreage is gradually increasing. Corn yields from 40 to 70 bushels per acre; oats, 50 to 65 bushels; barley, 35 to 50 bushels; timothy and clover, 1½ to 2 tons of hay; and sugar beets, 13 to 18 tons per acre. Other special crops grown are cabbage, which yields 12 to 14 tons; potatoes, which yield from 125 to 200 bushels; and tobacco, with yields ranging from 1,000 to 1,600 pounds per acre. Tobacco is usually grown on the same field for years, and most of the manure is applied to the tobacco patch at the expense of the rest of the farm.

In the improvement of this soil the correction of acidity is the most important thing. Phosphate fertilizer has been found to be very profitable, and its use is gradually increasing. Carefully worked out rotations also aid in production. Tobacco should be grown on the same field for only two or three years in succession. The two or three years of tobacco may be alternated with a general crop rotation.

While it is recognized that this soil is especially well adapted to corn, none of the farms can well be devoted exclusively to this crop. Rotation must be practiced in order to keep up the fertility of the land, but in such rotation corn can be the most prominent crop. It may be grown on the land two years in succession, followed by oats or barley, which is seeded to clover, and this followed by corn. Liming will be a benefit not only to the clover crop, but to all of the other crops grown, and each farmer should begin at once to lime his farm and plan to lime every field eventually.

CLYDE SILT LOAM.

The surface soil of the Clyde silt loam consists of 10 to 16 inches of black heavy silt loam. The subsoil grades through a few inches of dark-drab or bluish silty clay loam into plastic silty clay, which passes at 20 to 24 inches into stiff, impervious, mottled clay or yellow silty clay. Lenses of mottled clay and yellow fine sand a few inches thick are found here and there in the deep subsoil. There are a few variations in the surface material; locally the soil is slightly heavier than silt loam, and in some places loam areas have been included.

As developed in the old glacial area, chiefly in Sharon Town, the surface soil consists of 12 to 16 inches of dark-gray to black silt loam containing much organic matter. The upper subsoil consists of a grayish, yellowish, or sometimes bluish silt loam, which rapidly grades into a silty clay loam, and generally becomes a strongly mottled impervious silty clay below 20 inches. The heavy material extends to a depth of 4 feet or more and rests upon unassorted glacial material. In some places the soil is heavier than a silt loam and could probably be classed as a clay loam or silty clay loam.

The Clyde silt loam occurs in nearly all towns in the county, mostly in small tracts ranging in size from a few acres to a section or more. Very few areas contain more than 1 square mile. The small areas are most numerous in the towns of Linn, Bloomfield, Geneva, and Lyons.

The surface is level and gently sloping or saucer shape. The type occurs chiefly in long narrow strips occupying depressions in the upland; in places it occurs along drainage ways. It is all low lying and has poor natural drainage. Owing to its low position it frequently receives seepage from the adjoining high land. While the drainage is naturally deficient, the part which is the most elevated can sometimes be cultivated safely, although tile drains would be beneficial to all the land.

The material forming this soil consists for the most part of till derived by glacial action from the underlying limestone. As the soil occupies low places, there has been an accumulation of vegetable matter, the decay of which accounts for the dark color and the high organic content. Since this soil has been derived from limestone material and has received the wash from the higher land, it is well supplied with carbonates and no part of it is acid.

The original forest on this soil consisted of ash, elm, alder, and willow. Most of the merchantable timber has been removed, but there are still a few trees available for saw timber.

Probably half of the Clyde silt loam is under cultivation. The cultivated land is partly drained and lies between the upland and the lowest parts of depressions. The part of the type too poorly drained to be cultivated is indicated on the map by marsh symbols. Where the drainage is sufficient, corn, root crops, small grains, and hay are being grown, and where the drainage is not so good the land is used for pasture.

Drainage is, of course, the first and most important step in the improvement of this type. When completely drained it is one of the best types for corn in southern Wisconsin. It is also well adapted to sugar beets, cabbage, and hay. Small grains are inclined to lodge, and the quality of the grain is not quite equal to that grown on the upland soils. Wherever there is a small accumulation of peat or muck over the surface, the use of mineral fertilizers containing phosphorus and potash might be advisable during the early stages of cultivation. As the peat becomes mixed with the soil by cultivation, the need for mineral fertilizers will be reduced.

CLYDE SILTY CLAY LOAM.

The surface soil of the Clyde silty clay loam consists of 10 to 14 inches of black silty clay loam high in organic matter. This grades into a subsoil of drab, plastic silty clay loam, which grades through gray material mottled with yellowish brown and passes at about 2 feet into tough, impervious, mottled silty clay.

The Clyde silty clay loam is of small extent and is confined chiefly to the northwestern part of the county, where it occupies poorly drained depressions in some of the prairie regions. The surface is low, level, or saucer shaped, and the natural drainage is deficient. Part of it has been drained artificially and is being cultivated. The part that is too wet for cultivation and is in a marshy or water-logged condition is indicated on the map by marsh symbols. This type is derived largely from glacial débris, and because it occurs in depressions it contains a large accumulation of organic matter. In a few places where it occurs along stream courses it may be partly alluvial in origin.

The original timber on this soil consisted of elm, ash, soft-maple, and other water-loving plants. Parts of it may have been treeless or nearly so.

Probably half of the silty clay loam is under cultivation, and where fairly well drained it produces good crops. Drainage, however, is the important feature in improving this soil, and until artificial drainage has been supplied, crops can not be grown successfully year after year. When thoroughly drained, this is a strong, productive soil, well adapted to corn, hay, and root crops.

MAUMEE FINE SANDY LOAM (CLYDE).

The surface soil of the Maumee fine sandy loam, as mapped in this county, consists of a dark or nearly black fine sandy loam 8 to 12 inches deep. The subsoil is a drab or brownish fine sandy loam or sand, which extends to a depth of 4 or 5 feet, where it is underlain by red or pinkish heavy clay. The subsoil over the clay is somewhat variable in its content of fine material, and the surface soil is

somewhat variable in its color and content of organic matter, although it is darker in color than the upland soils. This type differs from typical Maumee fine sandy loam in having the light sandy layer in the subsoil and the heavy calcareous clay substratum.

The type occurs in Whitewater and La Grange Towns and occupies less than 1 square mile. In its surface features, drainage, origin, native vegetation, and agricultural development it is very similar to the heavy phase of this type described below. Drainage is of prime importance on this type, and farming can not be carried on successfully without artificial drainage.

Maumee fine sandy loam, heavy phase.—The Maumee fine sandy loam, heavy phase, consists of 12 to 18 inches of a black loam, passing through brown loam into mottled yellow and brown sandy loam at 20 to 24 inches below which it is a mottled yellow and gray loamy sand. The subsoil is somewhat gravelly in places, and is underlain at depths of 4 to 6 feet by dense impervious clay similar to the lower subsoil of the Poygan series. The surface soil is somewhat variable in the depth of the dark-colored material as well as in texture.

The Maumee fine sandy loam, heavy phase, occurs in Whitewater and La Grange Towns in the northwest corner of the county and comprises an area of a little over 2 square miles. It occupies low ground which is naturally poorly drained. The surface is level or somewhat saucer shaped, and the land is largely in a marshy condition. Some of it has never been utilized because of its lack of drainage. The drainage of this soil is slightly better than that of the Maumee silty clay, but artificial drainage is necessary to insure successful crop production. The land that is most poorly drained is indicated on the map by marsh symbols.

The clay in the deep subsoil is of lacustrine origin, having been deposited in standing water probably during glacial or interglacial time. The sandy and other material over the clay was probably deposited by water or at least modified by water since the deposition of the clay. The dark color is due to the accumulation and decay of organic matter under conditions of excessive moisture.

The native growth on this phase consists chiefly of alder, willow, ash, elm, and other water-loving plants. Some of it is rather open and only sparsely covered with brush and trees.

The better drained areas of this soil have been improved to some extent and devoted to the general farming crops of the area. Because of excessive moisture, crops do not make the best growth without artificial drainage, which has been supplied in some places. When thoroughly drained, the soil will produce good corn, hay, sugar beets, and other root crops. Some grains can be raised, but there is danger from lodging and the quality of the grain is not quite as good as on the upland. Methods for the improvement of the Clyde soils are applicable to this soil as well.

MAUMEE LOAM (CLYDE).

The Maumee loam to an average depth of 10 inches consists of a black loam; this grades through a subsurface layer of brownish or drab loam into a subsoil of mottled gray or yellow, sticky sandy loam, which changes at about 22 inches into mottled gray and yellow plastic clay. Stratified sand and gravel occur at or below a depth of 3

feet. There is some variation in this soil, chiefly in the texture of the surface material, and a few areas were included with the loam which would have been classed as fine sandy loam had they been more extensive.

The Maumee loam is confined almost entirely to the northern half of the county, chiefly in the town of East Troy. The type occurs on low stream and outwash terraces. The surface is flat and the natural drainage is poor. The soil has been derived from alluvial deposits, chiefly in the form of outwash plains. It is similar to Waukesha loam, except that the drainage is more deficient.

The Maumee loam is used for corn, hay, pasture, and small grains, but the soil is cold and wet in the spring and the crop yields are often unsatisfactory. In many instances the crops are spotted and uneven, owing chiefly to the poor drainage conditions. Drainage is the first and most important need in the improvement of this type. With adequate drainage, it will be a good soil.

MAUMEE SILT LOAM (CLYDE).

The surface soil of the Maumee silt loam has a depth of 10 to 14 inches and consists of black, rather heavy, silt loam, containing much organic matter. The upper subsoil is a heavy silt loam, lighter in color than the surface soil, which changes rather quickly into a drab, plastic silty clay loam and usually becomes a slightly mottled clay loam or clay below a depth of 2 feet. At a depth of 30 or 36 inches the heavy material generally grades into stratified sandy material which contains some gravel in places. The soil is similar to the Waukesha silt loam, except that it occupies a lower position and is not so well drained, which accounts for the mottling in the subsoil.

The Maumee silt loam occurs throughout many parts of the county. The largest areas are in the towns of Walworth and Darien.

The type has a flat surface and a rather low position, somewhat lower than the Waukesha soils with which it is usually associated. The natural drainage is slow, but is naturally good enough or can be improved so as to be sufficient for general farm crops. From the standpoint of drainage the type includes two classes of land, one which is sufficiently drained to allow cultivated crops to be grown and the other which is in a rather marshy condition and too wet for cultivation at the present time. This marshy land can all be drained and will, when improved, be equally as good as that which is now being farmed, the soil material being practically the same. Artificial drainage is needed over a large proportion of the Maumee silt loam before excessive moisture can be removed.

The Maumee silt loam occurs on terraces or outwash plains and has the same origin as the Waukesha silt loam. While a considerable part of this material came from glaciated limestone, a large part of the lime has been leached out, and an acid condition now exists over practically all of the type.

The area in Walworth Town is probably a part of the prairie in that section. Some of the other smaller tracts support some forest, mostly elm, soft maple, and ash.

The greater part of the Maumee silt loam is under cultivation and is devoted to the general farm crops. It is not quite as productive as the Waukesha silt loam because of the excessive moisture in places.

Where thoroughly drained, it has practically the same producing power as the Waukesha soils. The methods of fertilization, cultivation, and crop rotation are the same as on Waukesha silt loam, except that a larger percentage of the type is devoted to hay. The more poorly drained land is devoted almost entirely to hay and pasture.

Thorough drainage is the first and most important need in the improvement of this land. Tests should be made to determine the amount of lime required to correct the acidity. It is possible that phosphate fertilizers would give good results.

MAUMEE SILTY CLAY LOAM (CLYDE).

The surface soil of the Maumee silty clay loam is a black silty clay loam or clay loam, 10 to 12 inches deep, which is underlain by a clay loam or silty clay loam lighter in color and locally of a bluish shade or sometimes mottled. This heavy layer extends to a depth of 28 to 36 inches or more and is underlain by sandy material, usually stratified. The type is similar to the same textured soil in the Waukesha series, but the natural drainage is deficient and a mottled condition has developed in the subsoil. In a few places there is a sandy layer at a depth of 14 to 18 inches, but where this condition prevails a light-subsoil phase has been recognized and mapped. It is also somewhat similar to the Clyde silty clay loam in agricultural value, but the Clyde soil is not underlain by the stratified material.

The Maumee silty clay loam is found in various parts of the county but is most extensive in the northwestern part. It occupies terraces or outwash plains and has the same origin as the Waukesha soils. While a considerable part of the material came from glaciated limestone, much of the lime has been leached out, and an acid condition exists in places.

The surface is level and the natural drainage is poor. Artificial drainage is needed over a large proportion of the type before cultivated crops can be grown safely. A part of this land has already been partly drained and some of it is producing good crops. The undrained land is used chiefly for pasture and hay. When thoroughly drained this makes excellent land.

Maumee silty clay loam, light-subsoil phase.—The Maumee silty clay loam, light-subsoil phase, consists of a black silty clay loam extending to a depth of 8 to 12 inches, where it is underlain by a mottled gray and yellowish sandy clay loam, which grades into sand at 14 to 20 inches. This extends to a depth of 30 to 48 inches, where a dense, heavy, calcareous, mottled clay is found. The depth of the heavy surface soil is somewhat variable as is also the thickness of the bed of sandy material. The phase differs from the typical Maumee silty clay loam mainly in having the layer of sandy material in the subsoil.

This phase is practically confined to Whitewater Town, and occupies an area of about one square mile. The surface is level and the natural drainage is deficient.

The subsoil is largely of lacustrine material. The sandy material was doubtless washed into standing water, and the heavy material above it was doubtless deposited in standing water at a somewhat later date. The material has come from glaciated limestone débris and is therefore highly calcareous.

The native growth on this soil consisted of elm, ash, soft maple, willow, and alder. Practically all of the merchantable timber has been removed, but the land has not all been cleared and cultivated. A large part of the phase is either in farms or utilized for grazing. Because of its naturally poor drainage a considerable proportion of it is too wet much of the time for cultivated crops. The better drained parts are devoted to corn, small grain, and hay, and good yields are obtained. Open ditches or tile drains will be necessary over practically all of this land before it can be fully utilized.

MAUMEE SILTY CLAY (CLYDE).[7]

The Maumee silty clay consists of a black silty clay loam passing at a depth of 10 to 14 inches into mottled drab and yellow silty clay, which grades at from 18 to 30 inches into a dense, heavy, impervious clay, mottled with gray and yellow, and with a tinge of a peculiar pinkish color typical of the Superior soils mapped in other parts of the State. Both the soil and subsoil are calcareous.

This type is largely confined to Whitewater Town and covers an area of about 6 square miles. The type is level, low lying, and naturally poorly drained. Because of variations in the drainage conditions, a separation was made between the part which is artificially or naturally drained sufficiently to permit the growing of ordinary farm crops and that which is too wet at present to be used for cultivated crops. Marsh symbols are used to indicate poorly drained areas. There is practically no difference, however, in the soil, and when the country was new all of the type was poorly drained. The material forming this type is doubtless of lacustrine origin and was deposited in standing water. A part of the material may have been deposited prior to the most recent glacial period.

The original vegetation consisted of ash, elm, soft maple, willow, and other water-loving plants, including marsh grass and alder brush. The greater part of the type has been cleared and is utilized either for cultivated crops, pasture, or hay. Grazing and the cutting of hay are confined largely to the more poorly drained land. In the improvement of this type drainage is of most importance. When thoroughly drained this makes a strong and productive soil, adapted especially to corn and hay. Small grains can be grown, but they are in danger of lodging and the quality is not quite equal to that grown on the upland soils.

WABASH SILT LOAM.

The surface soil of the Wabash silt loam is a dark-brown to black smooth silt loam, which generally varies in depth from 8 to 18 inches, but in some places extends to a depth of 24 inches. The supply of organic matter is variable and in places is sufficiently high to justify the material being called a muck. The subsoil is a drab or mottled gray and yellow silty clay loam, which becomes heavier with depth. Lenses of fine sandy loam and gravelly material a few inches in thickness may occur through the subsoil. The soil is variable and includes some patches that could be classed as Genesee silt loam.

[7] State name is Clyde clay loam.

The Wabash silt loam occurs as first bottoms, chiefly along Honey Creek, Turtle Creek, Sugar Creek, and White River, and in small areas along other small streams in the northern half of the county. It is low lying and very poorly drained and is all subject to annual overflow.

The material forming this soil has been deposited from flowing water and is derived from the glaciated limestone material that forms the upland soils throughout the region. Because of leaching from the upland soils which are high in lime, this land is not acid, and the subsoil usually contains a considerable amount of carbonates.

The native vegetation consists of elm, ash, soft maple, willow, and alder. The greater part of the merchantable timber has been removed, but on the larger areas there are still some trees suitable for lumber.

Nearly all of the type is unimproved, as most of it is too wet in its natural condition for cultivated crops. In a few places, where it adjoins the high land, it is cultivated and in dry seasons produces good crops. However, the dangers from excessive moisture are so great as to discourage its cultivation. Some of the type is in grass and supplies good grazing part of the year.

Drainage, of course, is the most important factor in improving this type. This will call for the deepening of the drainage ways in most cases. If some of the large marshes are drained, this type will also be greatly benefited. When thoroughly drained, it will become a very productive soil, especially adapted to corn.

Wabash silt loam, light phase.[8]—The Wabash silt loam, light phase, is really the Genesee silt loam, but was mapped as a phase on account of its small extent. It is variable in texture. For the most part it consists of a brown or dark-brown, smooth, friable silt loam, underlain by mottled drab and yellow silt loam or silty clay loam, which contains numerous lenses of fine sandy material. These sandy layers vary from an inch or less to several inches in thickness. In places the subsoil to a depth of 3 feet is practically free from layers of sand, while in other places the greater part of the soil is sandy. The surface soil in places contains a relatively large proportion of fine sand.

This phase occurs chiefly in Richmond Town. Because of its small extent it is of minor importance in the county.

The soil is developed mainly in stream bottoms and the bottom of potholes or depressions that do not have adequate drainage outlets and are subject to overflow. It occurs also along the upper parts of intermittent drainage ways, where the material washed from adjoining slopes has been deposited, and at the mouths of gullies or on the lower parts of steep slopes. In all cases it is low lying and naturally very poorly drained. In some of the lowest situations there are small accumulations of peaty material from 1 to 4 inches thick. Such areas are very small and could not be shown on the soil map.

The forest growth on this soil consists of willow, alder, soft maple, ash, and elm. The greater part of the land is unimproved, but most of the merchantable timber has been removed. On some of the higher parts adjoining the high land small patches of this soil have been placed under cultivation, but owing to the excess of moisture the crop yields are usually low. Part of the land is used for pasture, which is the best use that can be made of it under present conditions.

[8] State name is Genesee silt loam.

Drainage, of course, is most important in the improvement of this soil. The soil in itself is fertile, and where it can be drained it will be adapted to the ordinary farm crops of the region.

PEAT.

Most of the type mapped as Peat consists of dark-brown or black fairly well decomposed organic matter passing at from 10 to 18 inches into lighter brown and less well decomposed material. In the larger areas the surface material in places is only slightly decomposed and lighter brown in color. In such places the original form of vegetation may be plainly seen and the bulk of the material is fibrous. In the small areas the sloping parts are sometimes of a springy nature and the black thoroughly decomposed Peat may extend to a depth of over 3 feet.

The subsoil under most of the Peat consists of heavy material ranging from gritty loam to silty clay loam. Where the neighboring upland is sandy, however, the material is frequently sandy below the Peat. In several places the Peat is underlain by marl. The depth of the Peat is somewhat variable, but will average more than 3 feet. Where the depth to the mineral soil is less than 18 inches, a shallow phase of Peat has been mapped.

Peat occurs in all towns and is more widely distributed than any other type in the county. The largest tracts are in the towns of Troy, Richmond, Sugar Creek, Whitewater, and Bloomfield. These larger tracts cover from 2 to 4 or more square miles. There are many tracts that vary from a few acres to one-half square mile in extent.

The Peat is all low lying. The surface is level or very gently sloping, and the natural drainage is extremely poor. Some of it is subject to overflow and over a great deal of it the water table remains close to the surface most of the time.

The material forming the Peat has been derived from the growth and accumulation of vegetable matter which is now in various stages of decomposition. In some cases this material is still raw, so that the original fiber can be seen. In other places it is thoroughly decomposed, so that the original structure has entirely disappeared. In some instances, especially around the marshes, a varying amount of mineral matter has been mixed with Peat, so that the result is soil approaching Muck. Because of the limited extent of this variation, however, the Muck is not shown separately on the soil map.

Owing to the large content of lime material in the deep subsoil throughout the upland, and because the water leaching from the upland and accumulating in the marshes carries lime, the Peat soil is not acid. A number of acidity tests were made on the Peat but only in a very few instances was an acid reaction obtained. There appears to be no relation whatever between the degree of decomposition and acidity. It is possible, however, that there might be some relation between the degree of decomposition and alkalinity.

Some of the marshes are treeless in part and are covered with a growth of sphagnum moss and coarse marsh grasses. The original tree growth in places consisted of a dense growth of tamarack, while in other places the growth was ash, alder, willow brush, and a scattering of tamarack. Some ash was also found where the Peat is shallow. Some marshes are partly open and partly forested. Most of the large

marshes are not included within drainage districts. Many outlet ditches have been or are being constructed, but in most cases only the outlet ditches have been constructed and lateral open ditches or tile drains have not yet been put in. When this land is thoroughly drained and properly fertilized, it will be adapted to a number of crops, including corn, sugar beets, cabbage, onions, and hay. Some grains may also be grown, but there is considerable danger of lodging, and the grain does not fill out as well as on the upland soils.

The question of fertilization is one of great importance, because the Peat soil is deficient in mineral plant-food elements, potash and phosphorus, and it is probable that both of these will have to be supplied before profitable crops can be grown continuously. On some marshes in southern Wisconsin it has been found by actual test that only one of these elements was required in the beginning. It is very evident that both must be supplied ultimately, however, because the total amount present is in all cases low.

Drainage is the first step necessary in the improvement of this type, and until thorough drainage is supplied it is useless to attempt cultivation. At present the Peat marshes are used chiefly for the production of marsh hay and some pasture. Only in a very few cases are cultivated crops being grown. Little tiling has been done on the Peat lands, but the importance of this is being appreciated and more attention than ever before is being given to the reclamation of the marsh lands. Because of the high value of the upland soils, it is desirable that the Peat soil should be under cultivation as soon as possible so as to make every acre on each farm productive.

When the deep Peat is thoroughly drained, properly cultivated, and fertilized, it will have a crop-producing power nearly if not quite equal to the upland and will have a selling value of probably about two-thirds or three-fourths that of the adjoining upland. It will have a lower selling value because it is not adapted to as wide a range of crops as the upland soils and also because it requires special treatment, with which many people are not familiar.

Peat, shallow phase.—The shallow phase differs from the typical Peat chiefly in the depth to the heavier underlying mineral soil. The peaty material in the shallow phase has a depth of 18 inches or less. Where associated with sandy upland, the underlying material is usually sandy, and elsewhere it is heavier. The soil section itself is practically the same as that of the deep Peat, consisting of decaying vegetable matter of a dark-brown or black color, with which there has been mixed a comparatively small proportion of mineral matter. The lower part of the peaty layer in places contains considerable mineral matter, especially where the subsoil is sandy, as in the areas mapped in the northern parts of La Grange and Troy Towns.

The greater part of the shallow phase is in Troy and La Grange Towns, but small areas also occur in most of the towns in the northern half of the county.

In regard to drainage, origin, and native vegetation this phase is practically the same as the typical Peat. It has not been developed agriculturally to any extent, but a few small areas have been placed under cultivation. Before much of it can be utilized for cultivation, it must be thoroughly drained. Where the subsoil is heavy, this shallow Peat has a greater potential agricultural value than the

deep Peat, because when the land is cleared and thoroughly drained the surface material will settle to such an extent that in many cases the heavy subsoil will be mixed with it in the cultural operations. When this land is thoroughly drained, properly cultivated, and fertilized, it will have a crop-producing power nearly equal to that of the upland soils.

SUMMARY.

Walworth County is situated in the southeastern part of Wisconsin and has a land area of 560 square miles, or 358,400 acres. The area of the lakes within the county amounts to approximately 14 square miles. The southern boundary line of the county is the Illinois-Wisconsin State line, and the eastern boundary is 24 miles from Lake Michigan.

The most important topographic feature within the county is the terminal moraine of the Lake Michigan and Green Bay glaciers. Within this morainic belt the topography ranges from rolling to extremely rough and broken. Outside of this belt the surface of the county ranges from level to gently rolling.

The drainage of the western part of the county is chiefly through Turtle Creek into Rock River. The drainage of the eastern part of the county is chiefly through tributaries of the Fox River which flows south into the Illinois River.

The county was established in 1838, but the first settlements were made in 1836. The population in 1920 was 29,327, of which 69.8 per cent was rural. The entire county is well provided with railroads and public highways, and all sections are well settled.

The climatic conditions are favorable for the high development of agriculture. The mean annual rainfall as reported at Delavan is 31.42 inches. There is a normal growing season between frosts of approximately 167 days.

The agriculture of Walworth County consists of general farming in conjunction with dairying. The principal crops are corn, oats, barley, clover, timothy, alfalfa, and wheat. There are other crops of lesser importance and also some special crops, including rye, buckwheat, tobacco, potatoes, sugar beets, peas, and cabbage. Hog raising has been developed extensively in connection with dairying, and some beef cattle and sheep are also raised. Stock feeding for market is also practiced in some parts of the county, although not extensively.

Land ranges in value from $25 to $300 an acre. The lowest value is in the extremely rough and broken lands in the morainic belt, and the highest priced farms are on the prairie lands, which are very highly developed and very productive.

The soils of Walworth County are derived chiefly from glacial drift, some of which has been worked and redeposited by the action of water. Fourteen series, represented by 28 soil types, including Peat, were recognized in the soil survey. A number of phases have also been shown.

The Bellefontaine series includes the light-colored upland forest soils in the glaciated limestone region, where the material is quite thoroughly oxidized and has a reddish-brown subsoil. The subsoil is rather open, consisting chefly of gritty clay loam, and the surface

is usually sufficiently undulating or sufficiently rolling to insure good drainage. The silt loam, loam with gravelly phase, fine sandy loam, and stony loam were mapped.

The Miami series includes the light-colored upland forested soils in the glaciated limestone region where the subsoil is rather compact to a depth of nearly 3 feet, there being considerably less gritty material than in the Bellefontaine soils, and the material is less thoroughly oxidized. In the old glacial area the depth of heavy subsoil extends to a depth of 3 feet or more, the depth to calcareous material being about 4 feet. The surface features are somewhat smoother than in the Bellefontaine series, and the natural drainage is not quite so thorough. Only the Miami silt loam was mapped.

The Conover soils may be considered as variations from the Miami. They occur on the lower slopes between areas of Miami and Bellefontaine soils and areas of Clyde or other lower lying soils. The Conover types have a grayish color with a mottled subsoil, and the natural drainage is somewhat deficient. The silt loam, with included areas of loam, was mapped.

The Coloma fine sand is a light-colored, extremely sandy, upland soil which has been leached to a considerable extent and is now in an acid condition.

The Rodman gravelly loam occupies rough and broken ranges of gravel hills which are made up chiefly of kames and eskers. The total area is small, but the contrast between this and other soils is very marked. The agricultural value is very low, the soil being extremely droughty.

The Carrington series includes the dark-colored upland prairie soils in the glaciated limestone region. The surface is level to gently rolling, the natural drainage is good, and the soils are highly productive, though usually acid. The types mapped are the silt loam and the loam with a gravelly phase.

The Fox series consists of light-colored outwash or terrace soils, developed under a forest cover and having a sandy or gravelly subsoil within the 3-foot section. The natural drainage is good. The types mapped in this county are the silt loam with a heavy subsoil phase, the loam with a gravelly phase, and the fine sandy loam.

The Plainfield fine sand is a light-colored soil very low in lime carbonate and usually acid, which occurs on terraces or outwash plains.

The Homer soils are similar to the Fox soils, except that they are poorly drained, contain some mottling in the subsoil, and lie slightly lower than the Fox types. The silt loam, with some included areas of loam, was mapped.

The Waukesha series consists of dark-colored prairie soils occupying terraces or outwash plains. The types mapped are the silt loam with a deep phase, the loam with a gravelly phase, the fine sandy loam, and the fine sand.

The Clyde series consists of low, poorly drained areas within the glacial-drift region where the material consists chiefly of glacial till, but where poor drainage has resulted in a sufficient accumulation of organic matter to give the soil an extremely dark color. The subsoil is mottled, the natural drainage is very poor, and the construction of drainage ditches is necessary before this land can be safely cultivated.

When thoroughly tiled it makes excellent land, usually considered the best corn land. The types mapped are the silty clay loam and silt loam.

The Maumee soils are similar to the Clyde, except that they were deposited mainly by flowing water. The subsoil is mottled and is underlain by sand and gravel, usually within 3 feet of the surface. The surface soils are dark colored, similar to the Waukesha, and may be described as poorly drained Waukesha soils. The types mapped are the fine sandy loam with a heavy phase, the loam, silt loam, silty clay loam with a light-subsoil phase, and silty clay.

The Wabash series consists of dark-colored first-bottom soils somewhat variable in texture, which are subject to overflow. Only one type, the silt loam, was mapped.

Peat consists of vegetable matter in varying stages of decomposition, which has been mixed with some mineral matter. Much of the Peat contains from 80 to 85 per cent of organic matter. It has been derived from decaying moss, grasses, and other water-loving plants. In places the material is thoroughly decomposed and is really Muck.

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U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF SOILS
IN COOPERATION WITH THE
WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY
AND THE UNIVERSITY OF WISCONSIN COLLEGE OF AGRICULTURE

SOIL MAP

WISCONSIN
WALWORTH COUNTY SHEET

CONVENTIONAL SIGNS

CULTURE
(Printed in black)

- City or Village, Roads, Buildings, Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort.
- Secondary roads and Trails
- Railroads Steam and Electric
- Bridges, Ferry
- R.R.crossings, Tunnel
- Ford, Dam
- School or Church, Cemeteries
- Mine or Quarry, Mine dumps, Made land
- Bluff, Escarpment, Rock outcrop and Triangulation station
- Stony and Gravelly areas
- Soil boundaries
- Boundary lines
- Boundary lines
- Boundary lines
- U. S. township and section lines

RELIEF
(Printed in brown or black)

- Contours, Depression contours
- Prominent Hills, Mountain Peaks
- Sand, Wash, and Sand dunes
- Shore and Low-water line, Sandbar

DRAINAGE
(Printed in blue)

- Streams
- Lakes, Ponds, Intermittent lakes
- Intermittent streams
- Springs, Canals and Ditches, Flumes
- Swamp, Salt marshes
- Submerged marsh, Tidal flats

The above signs are in current use on the soil maps. Variations from this usage appear in some maps of earlier dates.

LEGEND

FOX GROUP

- Fox fine sandy loam — Ff
- Fox loam — Fm
- Maumee fine sandy loam (Clyde) — Mf
- Fox gravelly phase — Fm
- Fox silt loam — F
- Heavy phase — Mf
- Maumee loam (Clyde) — Mm
- Heavy-subsoil phase — F
- Maumee silt loam (Clyde) — Ml
- Homer silt loam (Fox) — H

CLYDE GROUP

- Maumee silty clay loam (Clyde) — Mc
- Miami silt loam — Mo
- Light-subsoil phase — Mc
- Shallow phase — Mo
- Maumee silty clay (Clyde) — Ma
- Bellefontaine stony loam (Miami) — Be
- Peat — P
- Bellefontaine fine sandy loam (Miami) — Br
- Shallow phase — P
- Bellefontaine loam (Miami) — B
- Carrington silt loam — Cl
- Gravelly phase — B
- Carrington loam — C
- Bellefontaine silt loam (Miami) — Bs
- Gravelly phase — C
- Conover silt loam (Miami) — Co
- Waukesha fine sand — Ws
- Dark phase — Co

MIAMI GROUP

- Waukesha fine sandy loam — Wf
- Wabash silt loam — Wa
- Waukesha loam — Wl
- Light phase (Genesee silt loam) — Ws
- Gravelly phase — Wl
- Coloma fine sand — Cf
- Waukesha silt loam — W
- Plainfield fine sand — Ps
- Deep phase — W
- Rodman gravelly loam — Rl

NOTE:
The names in parentheses are those used in the report published by the State

Soils surveyed by W. J. Geib, in charge, L. R. Schoenmann, and W. B. Cobb of the U. S. Department of Agriculture, and V. C. Leaper and W. H. Pierre of the Wisconsin Geological and Natural History Survey

BASE MAP IN PART FROM U. S. GEOLOGICAL SURVEY SHEETS

Scale 62500
1 3 0 1 2 3 4 Miles

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Field Operations
Bureau of Soils
1920